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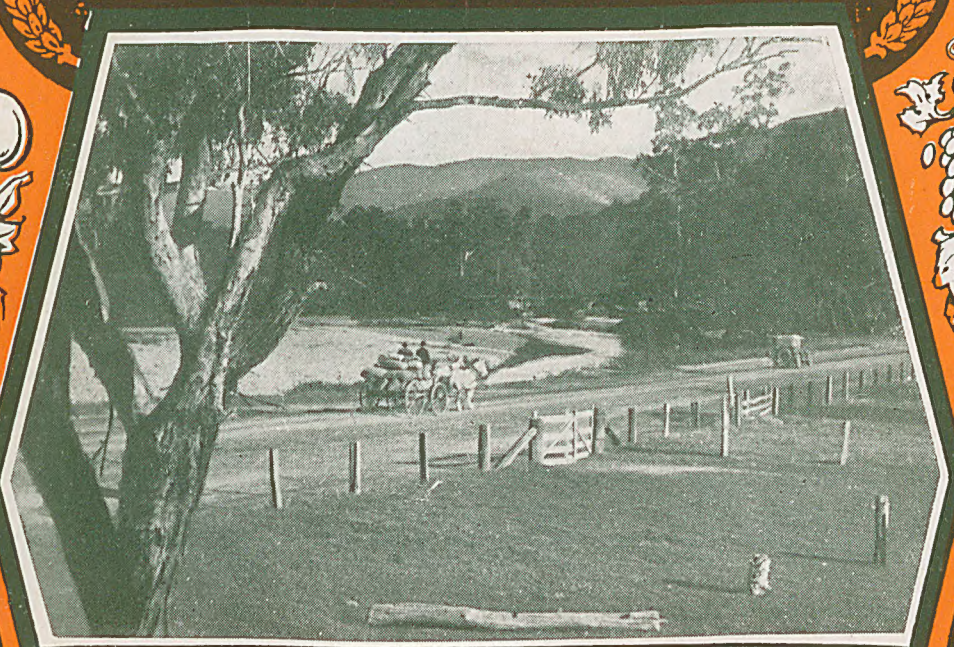
NATIONAL MUSEUM OF VICTORIA

VOL. XXXI. PART 5

The JOURNAL of AGRICULTURE

Of The Department

VICTORIA AUSTRALIA



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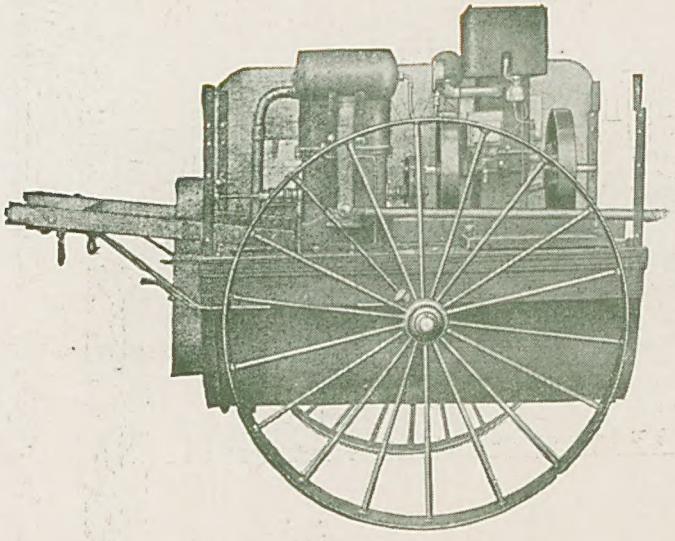

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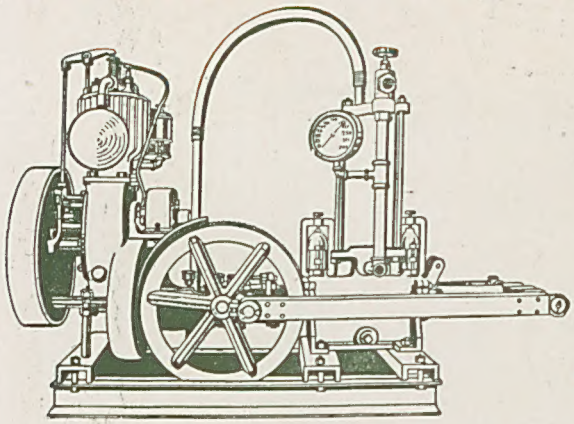

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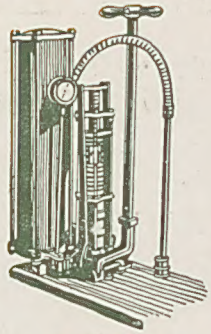

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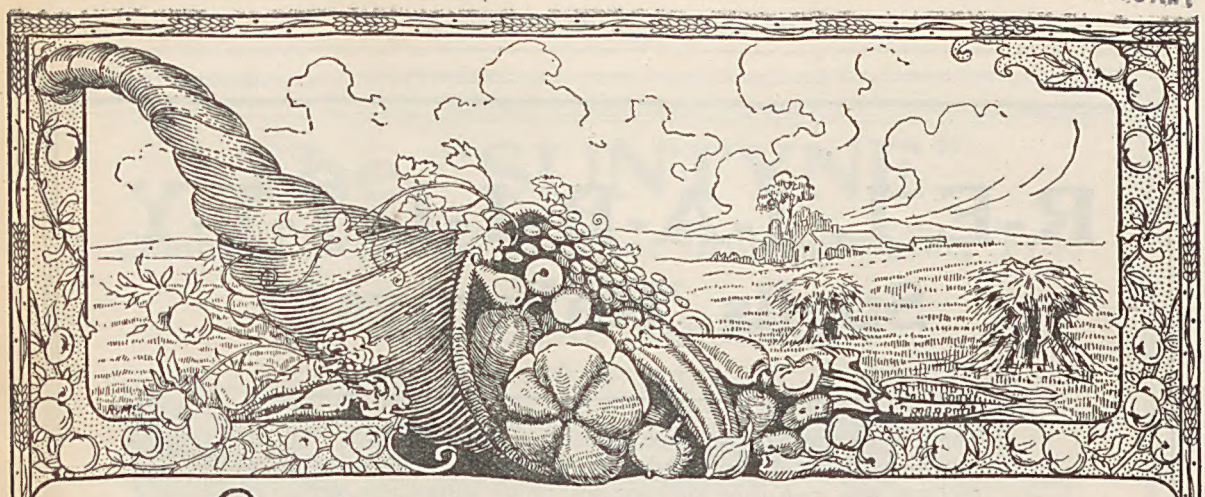

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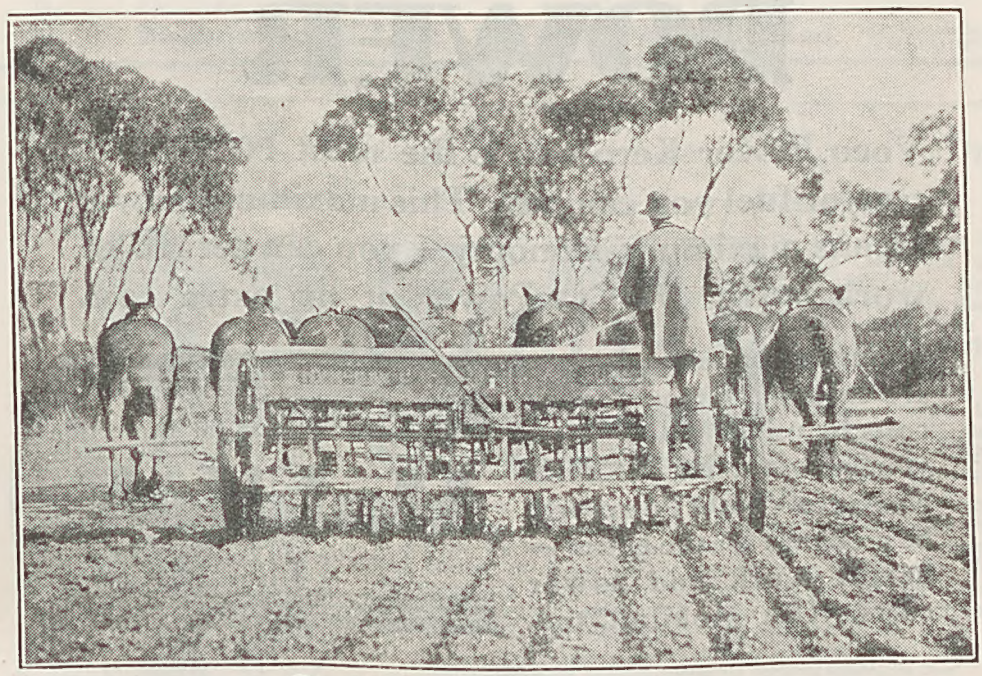

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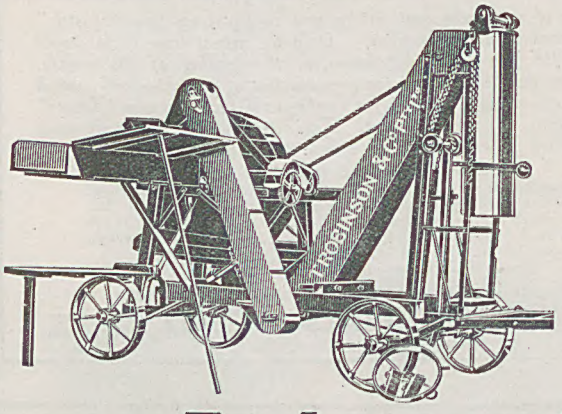

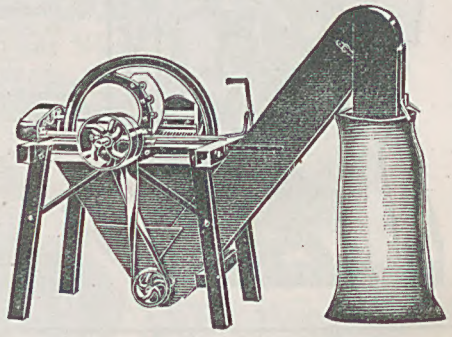

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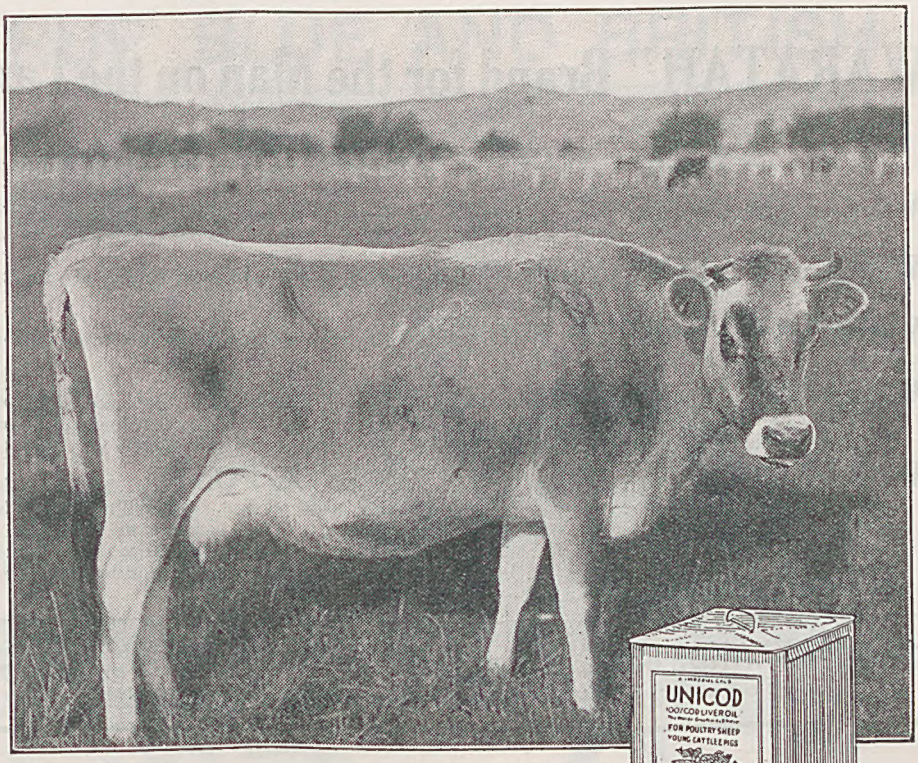

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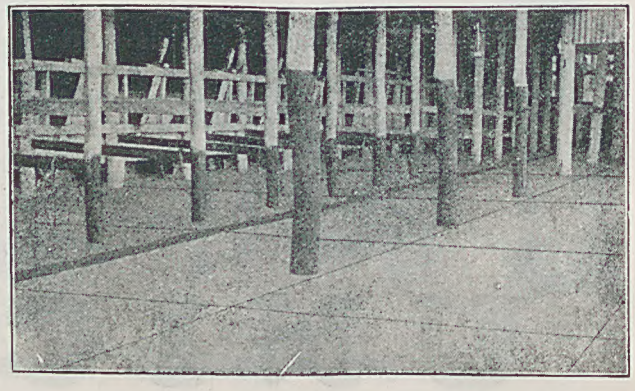

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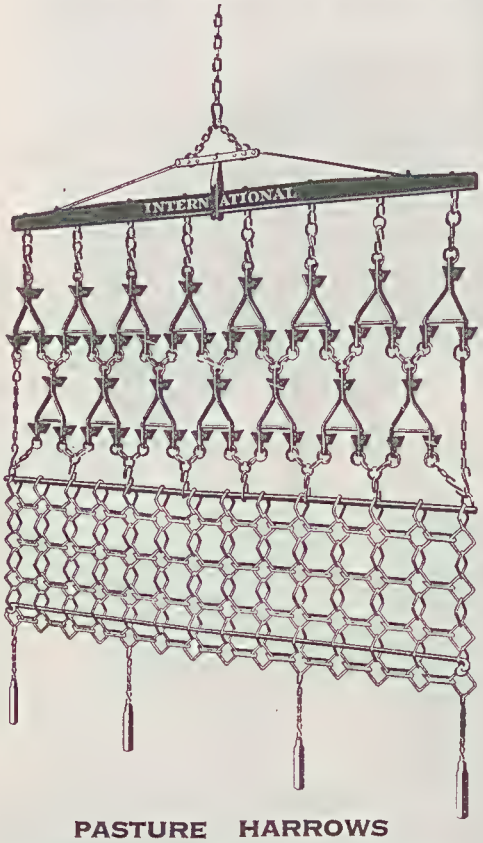

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Pasture Establishment

The Principal Strains of Pasture Seeds

By F. R. Drake, B.Agr.Sc., Assistant Agrostologist.

SO far this season conditions in southern Victoria have been eminently suitable for sowing down new pastures. Occasional rains have alternated with warm dry spells throughout the autumn, and given farmers the opportunity to get their land in very good order. A fine tilth has been readily obtained, rains have been sufficient to secure a good strike of weeds, which it has been possible to kill by harrowing, and, where preparation has been adequate, the soil is now in a fine, warm, moist condition, ready for sowing down.

Many fields have, in fact, already been sown —a commendable achievement—especially in Gippsland, and other hilly districts, where early sowing is of much importance if a well-rooted pasture is to be established before the winter sets in. However, numerous requests are still being received for information in regard to various aspects of pasture establishment, and it would appear that there is still a great deal of planting to be done. For this reason a few notes on the commercially available strains of the common pasture species may not be too late to be useful to some growers.

Perennial Rye-grass.

There are only three main strains of perennial rye-grass from which the purchaser may make his choice of seed. These are—

(*a*) Victorian or local strain.

(*b*) New Zealand strain (certified by the New Zealand Department of Agriculture).

(*c*) United Kingdom imports, mainly Irish rye-grass.

Victorian perennial rye-grass seed is harvested mainly around Colac, Kyneton, and Ballarat, where a number of old-established growers, who have built up their own private connexions over many years, are situated. In each of the above towns also there are merchants who handle only local old pasture seed, and who do a fairly extensive trade in it. At Colac the growers have organized themselves into an association known as The Colac Perennial Rye Grass Growers Limited, which is selling seed certified as having been harvested from pastures provisionally approved of by the Department of Agriculture as suitable for the production of perennial rye-grass seed.

The Victorian strain is a thoroughly reliable type with which to establish permanent pastures. Uncertified seed can be obtained with reasonable certainty from leading merchants, though it is wise always to buy with care and discrimination as to origin, purity, and germination.

New Zealand perennial rye-grass seed is obtainable in sealed sacks containing about 8 bushels each, and bearing a certificate by the New Zealand Department of Agriculture.

This certificate is valuable as a means of maintaining the identity of the seed in commerce, and is a kind of identification tag which may be depended upon.

Two classes of seed are certified:—

(*a*) Mother seed, the product of old pastures, which have passed certain examinations. This seed is used in New Zealand mainly to sow down for a seed crop, which may be included in the next class (*b*).

(*b*) Permanent pasture seed. This may be the product of old pastures undergoing trial as Mother Seed areas, or it may be seed harvested from an area sown down with Mother seed.

This New Zealand strain is also a thoroughly reliable type with which to sow down permanent pasture. If complete sacks are bought, the sealed and certified seed is very reliable as to type. It is important to note, however, that the certificate gives no warranty as to purity and germination.

United Kingdom Imports consist mainly of Irish rye-grass. This strain is very distinct from the previous two, which are not unlike each other. It exhibits very poor adaptation to our climatic conditions, and is a relatively low producer when compared with the Victorian and New Zealand strains, though it is definitely perennial rye-grass. It is variously described as Irish perennial, Irish Ben, Pacey's short seeded, &c. About 20,000 bushels are stated to have been imported this season by merchants.

These three strains, Victorian old pasture, New Zealand certified, and Irish rye-grass, are the only perennial rye-grasses in Victorian commerce, though various other sorts may be advertised. It is largely a matter of experience and taste which strain is used, but the purchaser certainly should satisfy himself that he is getting sound, reliable seed of one of these three strains.

Perennial rye-grass seed is small and heavy. It has no awn like Italian rye-grass, and is only half the size or less of that of Wimmera rye-grass. It must be admitted that Wimmera rye-grass sometimes passes into commerce as Western District rye-grass, but the large seed should deceive no one. Uncertified New Zealand rye-grass is much more insidious. It is certainly not perennial rye-grass, though some of our leading merchants cling to an old and exploded belief, and still describe it as such. It is a very mixed variety, but consists mainly of inferior short-lived stemmy types, showing some similarity to Italian rye-grass. Its seed is larger than that of perennial rye-grass.

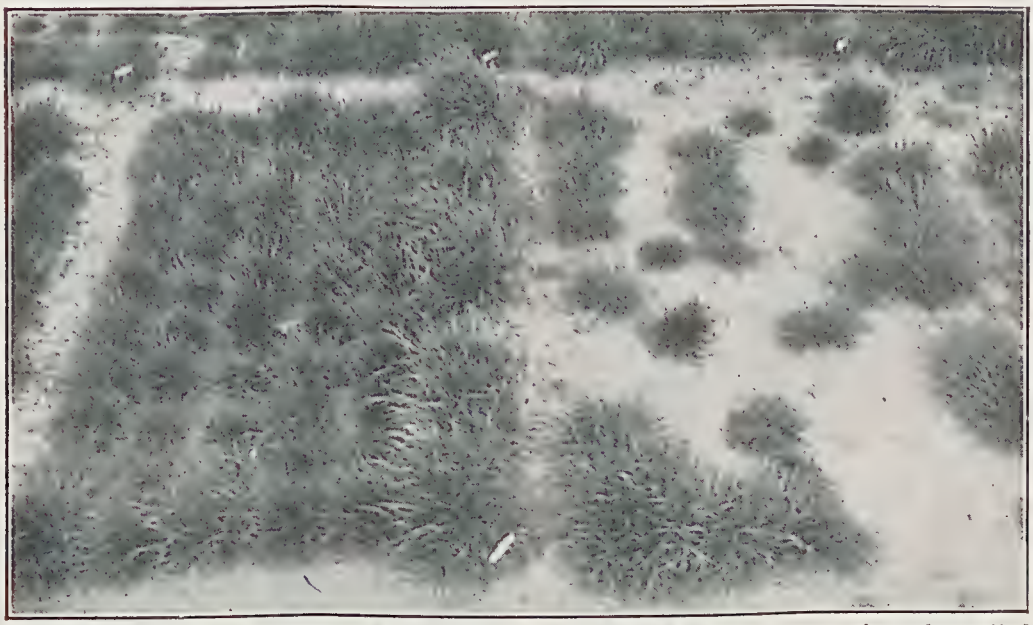
Cocksfoot.

The seed on the market originates from three sources—

Victoria.
New Zealand.
Europe—mainly Denmark.

Fortunately for the purchaser it is usually possible for him to obtain locally harvested

General view of the Rye-grass strain trials, Burnley.



A typical plot of uncertified New Zealand Rye-grass (right) in which many plants have died and the survivors are commencing to make stemmy growth in the second spring.

seed in his own district. Throughout the hill country in Gippsland and Beech Forest, cocksfoot seed is commonly included in all-mixtures sown, and may even comprise the bulk. There are farmers in all such areas who harvest cocksfoot seed as a side line each year, and sell it to their neighbours. Local cocksfoot is usually of a good strain, especially if derived from old-established stands such as occur throughout the hill country, and purchasers may reasonably depend on getting a good article. The seed to be avoided is that from new fields which have been sown down to some unknown strain. Most of the seed harvested in Victoria is sold privately, no great quantity being handled by the merchants, who complain of the difficulty of obtaining really clean seed of sufficiently attractive appearance to compete with imported seed. In spite of the growing appreciation of the value of strain, seed is still largely bought on its appearance, and while one hopes for a sufficient increase in the quantity of seed harvested locally to displace that of inferior imported strains, such increase will be slow until local methods of harvesting and cleaning the seed are considerably improved.

New Zealand cocksfoot seed has a good reputation in Victoria, and certified seed is now being marketed, as Mother and Permanent Pasture seed, in the same manner as perennial rye-grass. The seed is harvested from old pastures mainly about Akaroa, on Banks Peninsula, in the South Island. This Akaroa cocksfoot is a good leafy and high-producing strain, being very similar in all respects to the best Victorian old pasture type.

Cocksfoot is a grass which, unless carefully managed, tends to develop a considerable amount of stem which, if allowed to ripen, becomes harsh and indigestible. With all pasture plants, those which produce the highest proportion of leaf to stem are the most valuable, and this applies particularly to cocksfoot. The Victorian old pasture type, and the New Zealand certified type, both contain a fairly high proportion of leafy, rather than stemmy plants, and under favorable conditions are capable of yielding a large quantity of palatable leafy herbage. These two strains have developed under pasture conditions, and while they may be improved by increasing still further the proportion of predominantly leafy plants which they contain, they represent the best that is at present available.

Danish cocksfoot, which is still extensively used in Victoria, has been developed as a seed-producing plant. It consists mainly of plants which run to seed, and therefore to stem, early in the season, and the proportion of leaf to

stem is low. Even when kept cut or grazed, and thus prevented from running to stem, the plants have not a great capacity for producing leafy tillers, and under pasture conditions it tends to be less persistent than the more productive and leafy types. The use of Danish cocksfoot seed in permanent pasture sowing is therefore not to be encouraged, even when its low price and usually clean and attractive appearance are taken into account.

White Clover.

No white clover seed is harvested in Victoria, and the whole of the fairly large quantity used is imported. White clover may be conveniently considered under the following three headings:—

(1) Seed imported from European countries, and known as "White Dutch Clover."
(2) Seed imported from New Zealand.
(3) Kentish Wild White Clover.

White Dutch clover is used in the largest quantity, it being the cheapest white clover seed available. The whole of this year's supply has come from Poland. Any sample of white clover, if grown as single plants, is found to contain a very wide variety of plants. In white Dutch clover most of the plants are of a rather lax or open habit of growth, flowering early and very freely. This type is usually short-lived, and may be expected to persist and spread only by re-seeding rather than vegetatively. From single plant trials it has been demonstrated that white Dutch clover is little better than an annual, although some longer-lived plants are occasionally present. The extent to which it will persist, however, under Victorian climatic conditions by re-seeding, is not yet fully known, but it is probable that in many Victorian pastures in which white clover is present, the amount of seedling growth from year to year is considerable.

New Zealand White Clover.—Ordinary or uncertified New Zealand white clover is somewhat similar to white Dutch clover, but generally contains a proportion of more vigorous, denser, and longer-lived plants, and its use in preference to white Dutch is recommended on this account. Only a small quantity has been imported this season, however, and the price is higher than that of white Dutch clover. New Zealand certified white clover is described by New Zealand authorities as containing a good proportion of plants of an exceptionally vigorous type, with large leaves, stout stolons, and a dense habit of growth. These plants are also long-lived, with a long period of growth, and under favorable conditions will tend to dominate and ultimately displace plants of a less vigorous habit.

In all but the most favoured parts of Victoria white clover persists with a certain

White Clover strain trials at Burnley.

amount of difficulty, and in all parts of Victoria, except in exceptional seasons and under irrigation, growth is limited during mid-summer by lack of moisture. In many places, therefore, conditions would not allow the New Zealand certified type of white clover to grow to its fullest capacity, and for this reason, and because the seed is expensive, it is suggested that if used on any but the best country, New Zealand certified white clover should be sown as a blend, mixed with a cheaper type of white clover. If sown in this way, the better type of plant will be introduced, and if conditions are favorable, it may be expected to gradually increase in amount. New Zealand white clover is now certified to, not on age of pasture as was originally done, but only after a field trial to confirm the type.

Kentish Wild White clover is not used to any extent in Victoria, and is now rarely imported, probably on account of the very high price of the seed. It is a wild form of white clover, found in the closely-grazed old pastures of southern England. It is a small leaved, dense, and very close-growing plant, which is admirably suited to withstand close grazing, and is very persistent. It is described as being very much less productive in New Zealand than the New Zealand certified type.

Subterranean Clover.

Practically all the subterranean clover seed on the Victorian market is of the one type—a mid-season variety of great uniformity, and well suited to most conditions. Variations occur in the germination, or rather in the number of hard seeds present in samples from different sources. South Australian seed from the Mount Barker district has acquired a good reputation on account of its purity, and the high proportion of readily germinable seeds which it contains.

Small quantities of a very early Western Australian variety known as Dwalganup are also on the market. The plants of this variety are small and very stemmy, and its possible use is restricted to dry districts with a short-growing season.

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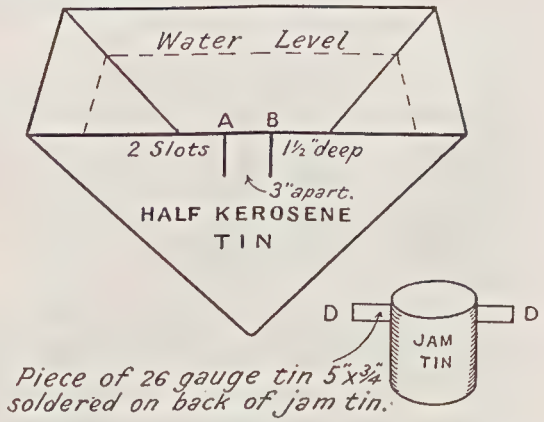
A Sheep Blow-fly Trap

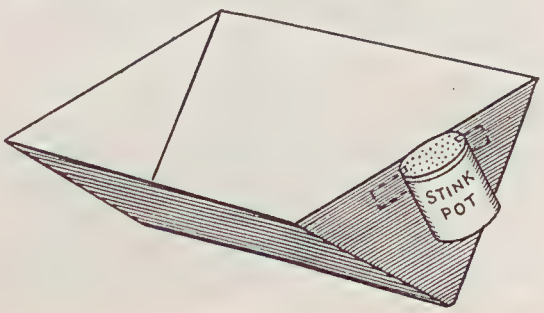
THE accompanying diagram shows a sheep blow-fly trap made from half a petrol tin, which has been used with success on the property of Mr. S. Wilson, of Lake Cowal, Marsden.

To make the trap a petrol tin is cut longitudinally along opposite corners, each tin thus providing two receptacles. Any holes must be soldered up.

Scraps of meat are placed in the trap and just covered with arsenic water; arsenic is used at the rate of 1 lb. to 100 gallons of water. A 1½-lb. jam tin over the mouth of which a piece of gauze tin has been secured is soldered to the trap by strips of tin. If desired the lid of the tin may be soldered and finely perforated. In the jam tin a piece of liver or some other meat is placed and covered with clean water to make a "stink pot."

A hole is made about half way along one side of the trap; through it a piece of wire is run, and by this the trap is hung on the side of tree; the top side of a sloping tree is the most suitable position.



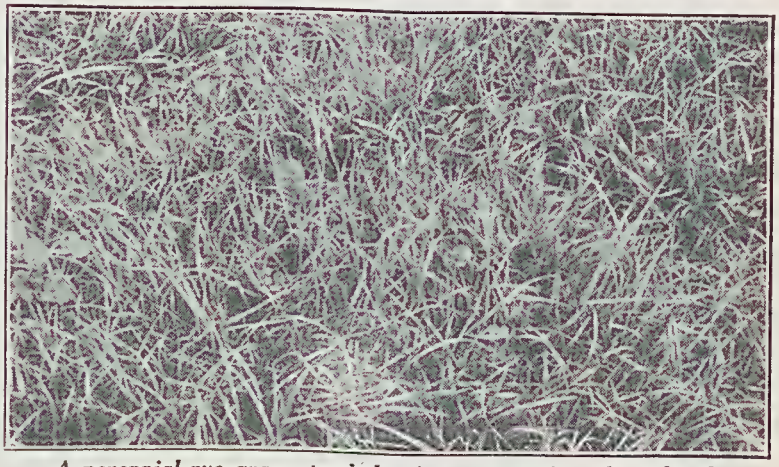


Permanent Pasture Mixtures

Species Recommended

By J. E. Harrison, B.Ag.Sc., Senior Agrostologist

PERENNIAL rye-grass, cocksfoot, white clover and subterranean clover are the species mainly employed in compounding permanent pasture mixtures. Two or more of each are generally used, chiefly according to the ability of the climate and the soil of a district to maintain them. The scope of each species is limited to the extent of its adaptation to a certain environment. Each has a degree of elasticity which allows it to range across the full breadth of the environment, which may be from light to moderate rainfall, or moderate to heavy, and from sands to loams or loams to clays; but it is definitely restricted within these limits. It is thus of importance to appreciate the chief characteristics of the above principal pasture species if each is to be employed in its proper place, and to the best advantage.



A perennial rye-grass stand showing suppression of weed and other growth.

Perennial rye-grass is adapted to soils of heavy or medium texture, and makes its growth during autumn, winter, and spring; but is dormant during summer. It is suppressive of other plants, and should be used in small or moderate proportions, if the presence of other grass species is desired to any extent. On suitable soils and in favorable situations it will form a permanent pasture in areas receiving as little as 20 inches of rain annually, though for general purposes on a wider range of soils about 25 inches or more appears to be required.

Cocksfoot prefers deep, free loams and peaty soils, though it also thrives well on somewhat heavier classes of soil. It is valuable for its summer and autumn growth, but being a summer grower, it requires fair summer rains. In the Gippsland hills it is often described as the "dry-weather grass," though it must be stated that the Gippslander's conception of dry weather is not quite the same as that of farmers in other parts of the State. Cocksfoot is at its best in areas receiving 40 inches or more of rainfall a year, and then forms a highly productive pasture under favorable summer conditions. Apparently it would also form a satisfactory pasture on certain soils in areas receiving 30 inches or even less, but it would be necessary to give it greater protection during the summer months if it were not to succumb to over-grazing. The fact that it gives a green summer bite renders it highly susceptible to selective grazing in areas like Central Victoria and the Western District, where the summer is dry and every green blade is sought after. If not protected more than usual under such conditions cocksfoot is very vulnerable, and is seriously weakened, and even killed, by continuous grazing.

White clover also is adapted to moist conditions. It prefers the same class of soil as rye-grass, and the fairly heavy and well-distributed rainfall favorable to cocksfoot. It is thus usually found associated with rye-grass under very good conditions, and this gives the key to the pasture mixtures in which its inclusion would be most suitable.

There is an important point concerning white clover in pasture management which should not be overlooked. It is a lowly creeping plant which is largely crowded out by tall growth, and is, for example, seriously checked by a hay crop. Close grazing is therefore desirable to maintain white clover in plentiful proportion in a pasture, so that it may make a liberal contribution to the composition of the sward.

Subterranean clover exhibits adaptation to very wide differences in rainfall. Though it definitely prefers free loamy soils for maximum growth, it grows under all conditions with rye-grass or cocksfoot where white clover is a doubtful or definitely negative quantity. It is capable of good growth also on lighter soils and in areas of lighter rainfall than perennial rye-grass, and is thus often found as companion plant to our native Wallaby grass or Danthonia, and to annual grasses such as Goose grass (*Bromus mollis*), Spear grass (*Bromus sterilis*), and Wimmera rye-grass (*Lolium subulatum*). It makes exceptional response to phosphatic top-dressing.

Subterranean clover is an annual, and arises as a self-sown crop each year, providing valuable winter as well as late autumn and spring feed. If good winter growth is to be obtained, the young plants should receive protection in autumn to give them an opportunity to become well established and deeply rooted before winter sets in.

Mixtures and Quantities.

The rate of sowing depends upon many factors, and perhaps as much upon the purse as any other. If the soil is in very good order, less seed is required than for a rough seed-bed, and a saving may be made in this way. If seed has a high germinating capacity as well as a rapid one, still less seed need be sown. This advantage may be offset to some extent by a slightly higher price for such seed, but the difference is usually to the farmer's advantage, and it pays to buy good seed. An early sowing may also be somewhat lighter than a late one, and it is an advantage for the sake of economy as well as for the best establishment of a pasture to sow reasonably early in the autumn.

It is customary—and the custom appears to have a sound basis—to sow more heavily in some districts than others. The heaviest and most expensive sowings are made in Central and South Gippsland, Beech Forest, and such places where rainfall is heavy. Not only are more comprehensive mixtures possible in these moist and fertile areas, but weeds are usually more abundant and heavy seedings are more desirable to combat them. In areas of moderate rainfall, where simple mixtures are used, and weeds are not so troublesome, it is a common matter to sow down at a cost of 10s. per acre or less; whereas in areas of high rainfall, where more complex mixtures are the order of the day, and where weeds are more competitive, it usually costs from £1 to £1 5s. or more per acre.

A common mixture in areas of moderate rainfall, in which lie the better pastoral areas of the State, is the following:—

		s.	d.
Perennial rye-grass ..	10 lb. at 10s. per bus. ..	5	0
Subterranean clover ..	2 lb. at 1s. per lb. ..	2	0
	12 lb. per acre. Cost =	7	0

It is a frequent practice to sow oats for hay the first year, and broadcast subterranean clover seed as soon as the oats are sown. The clover becomes well established, and seeds freely in the oat crop, leaving sufficient seed in the soil to provide a good stand for the next year, when perennial rye-grass is introduced by drilling in about 10 lb. of seed per acre on to the stubble across the old oat rows.

The same mixture of perennial rye-grass and subterranean clover is sown down in various proportions and in various quantities throughout the intermediate areas of the State, though not often in greater amount than the following:—

		s.	d.
Perennial rye-grass ..	20 lb. at 10s. per bus. ..	10	0
Subterranean clover ..	5 lb. at 1s. per lb. ..	5	0
	25 lb. per acre. =	15	0

Lucerne, at the rate of 2 or 3 lb. per acre, is sometimes introduced with advantage, particularly on deep, free, well-drained soils. Strawberry clover and white clover are often added, and may even displace the subterranean clover on heavy black flats, but the perennial

rye-grass—subterranean clover combination must be regarded as the best all-round and least expensive general-purpose mixture known for our intermediate areas at the present time. Many farmers sow rye-grass only, and wait for volunteer clover growth—cluster, suckling, knotted, and other annual clovers—to appear, and provide the legume content of the pasture. In this connexion it is interesting to note that the first of these, cluster clover, is increasing in popular regard, and flowing more freely in commercial channels, especially in Central Victoria, where it is regarded as being very suitable to the district.

In the margin between these intermediate areas and those of more favorable rainfall, the possibility of introducing cocksfoot arises, but there are difficulties associated with its inclusion. If sown with much rye-grass it encounters intense competition; if grazed continuously during the summer it is seriously weakened, and if a long dry summer prevails it loses its hold, and may die or be pulled or knocked out. It therefore seems necessary in such areas, if cocksfoot is to play a part, to sow it either separately or with little rye-grass, and graze it intermittently during the summer. A mixture suggested is—

		s.	d.
Cocksfoot	15 lb. at 1s. per lb.	15	0
Perennial rye-grass	5 lb. at 6d. per lb.	2	6
Subterranean clover	2 lb. at 1s. per lb.	2	0
	22 lb. per acre. Cost =	19	6

The value of cocksfoot in such areas lies in the amount of green feed it might produce during the dry summer months. The value of lucerne in this respect, however, is unsurpassed, and though cocksfoot might be successfully sown down in a field or two, the present tendency of farmers to adopt lucerne as the plant to fill the gap between spring and autumn in the supply of green feed has much to commend it.

In this marginal area between moderate and heavy rainfall districts there are soils and situations where white clover and strawberry clover command attention, and should be included in the mixture, as for example, as follows:—

		s.	d.
Perennial rye-grass	20 lb. at 6d. per lb.	10	0
White clover	1 lb. at 1s. 6d. per lb.	1	6
Strawberry clover	4 oz. at 6s. per lb.	1	6
Subterranean clover	2 lb. at 1s. per lb.	2	0
	23¼ lb. per acre. =	15	0

Some farmers prefer to omit subterranean clover from such situations, and increase the amounts of white and strawberry clover. This is a matter of judgment, and of knowledge as to the suitability of a field to these species. If the subterranean clover is omitted, but top-dressing is practised, a volunteer growth of various clovers will normally arise within a few years if the white and strawberry should fail.

In the areas of high rainfall, careful appreciation of the requirements of each species is needed if a thoroughly satisfactory mixture is to be compounded. The soil preferences and water requirements of each should be carefully considered before deciding what to sow in a field, or in fact in different portions of a field. For example, white clover is selective of moist patches, and subterranean clover of dry places; rye-grass exhibits a preference for heavy, well-compacted soils, and cocksfoot for deep and porous soils. In a general way rye-grass and white clover show adaptation to similar areas, and so also do cocksfoot and subterranean clover, but there are exceptions to this rule. It is, however, a very useful guide, and mixtures may with a reasonable assurance of success be compounded according to the following directions:—

For heavy soils—		s.	d.
Perennial rye-grass	25 lb. at 6d. per lb.	12	6
White clover	3 lb. at 1s. 6d. per lb.	4	6
	28 lb. per acre. Cost =	17	0

For light porous soils—		s.	d.
Cocksfoot	25 lb. at 1s. per lb.	25	0
Subterranean clover	4 lb. at 1s. per lb.	4	0
	29 lb. per acre. Cost =	29	0

For general purposes on heavy to medium soils—		s.	d.
Perennial rye-grass	15 lb. at 6d. per lb.	7	6
Cocksfoot	10 lb. at 1s. per lb.	10	0
White clover	2 lb. at 1s. 6d. per lb.	3	0
Subterranean clover	1 lb. at 1s. per lb.	1	0
	28 lb. per acre. Cost =	21	6

For general purposes on medium to light soils—		s.	d.
Cocksfoot	15 lb. at 1s. per lb.	15	0
Perennial rye-grass	7½ lb. at 6d. per lb.	3	9
Subterranean clover	2 lb. at 1s. per lb.	2	0
White clover	1 lb. at 1s. 6d. per lb.	1	6
	25½ lb. per acre. Cost =	22	3

[Continued on page 237.

Subsidy on Artificial Fertilizers

Particulars for Claimants

PART VII. of the Commonwealth Relief Act, No. 64 of 1932, provides for the payment *to primary producers* throughout Australia of a subsidy of 15s. per complete ton of artificial manure used by such primary producers in the production of primary produce other than wheat during the year ending 30th November, 1933. This means that, providing a primary producer has applied to the soil during the period 1st December 1932, to 30th November, 1933, one ton of artificial manure in connexion with the production of any primary product, *except wheat,* he will be eligible to claim 15s. subsidy. If he has used two tons during that period he will be eligible to receive 30s., and so on; but if he has used less than one ton no subsidy is payable.

The financial assistance in regard to the use of artificial manure applies to primary producers in respect of every product except wheat. Special provision has been made for wheat-growers under Commonwealth grants distributed by the States. Producers of oats, barley, hops, beans, apples, pears, citrus fruit, tobacco, &c., will therefore be eligible to claim the subsidy, which will apply also to artificial manure used in top-dressing of pastures.

Artificial manure for the purposes of the Act is defined as any substance which contains nitrogen, phosphoric acid or potash, and which has been manufactured, produced or prepared in any manner for the purpose of fertilizing the soil or supplying nutriment to plants, but does not include any animal or vegetable matter which has not been subjected to process or manufacture. Lime does not come within the meaning of the term "artificial manure" for the purposes of the Act.

All the fertilizers registered at the office of the Director of Agriculture, Victoria, under the *Fertilizers Act* 1928, are artificial manures for the purposes of the Commonwealth Financial Relief Act.

Applications for the subsidy must be made *in ink* by primary producers on a special form, and these applications will require to be completed by the primary producer and sent by him to the supplier of the artificial manure for his certificate as provided on the form. The supplier will then send the application to the Fertilizer Subsidy Section of the Department of Commerce in the State in which the fertilizer has been used. Victorian claims will be sent to the Secretary, Department of Commerce, 419 Collins-street, Melbourne. Forms of application have been distributed to country Post Offices. Any primary producer who may experience difficulty in securing a form should communicate with the Department of Commerce, 419 Collins-street, Melbourne, where a reserve supply of forms is held.

It will be noted that primary producers are not eligible to submit applications for the subsidy until they have actually *used* the artificial manure in regard to which they desire to claim financial assistance. They should use the full quantity of artificial manure which they intend to apply in regard to any particular product before submitting an application. They should not submit a claim in regard to a portion of the quantity used, and then submit one or more claims in regard to the remainder.

The declaration to be completed by applicants for the subsidy as shown on the form of application, must be made in the presence of either a commissioner for declarations, a J.P., bank manager, postmaster, stationmaster, or constable or officer of police. No other official is authorized to take this declaration.

Primary producers are requested to exercise every care in completing their claims so as to ensure that they claim the subsidy only in respect of artificial manure *used* during the period 1st December, 1932, to 30th November, 1933. If the artificial manure was applied to the soil prior to 1st December, 1932, no subsidy is payable. It must also be used prior to 30th November, 1933, to be eligible for the subsidy. All the particulars asked for on the form of application must be filled in by the applicant, otherwise delay will be caused in finalizing the claim owing to the necessity of returning claims to primary producers for completion or correction.

Burnley Egg-laying Competition

Results of 1932-33 Test

By W. C. Rugg, Chief Poultry Expert

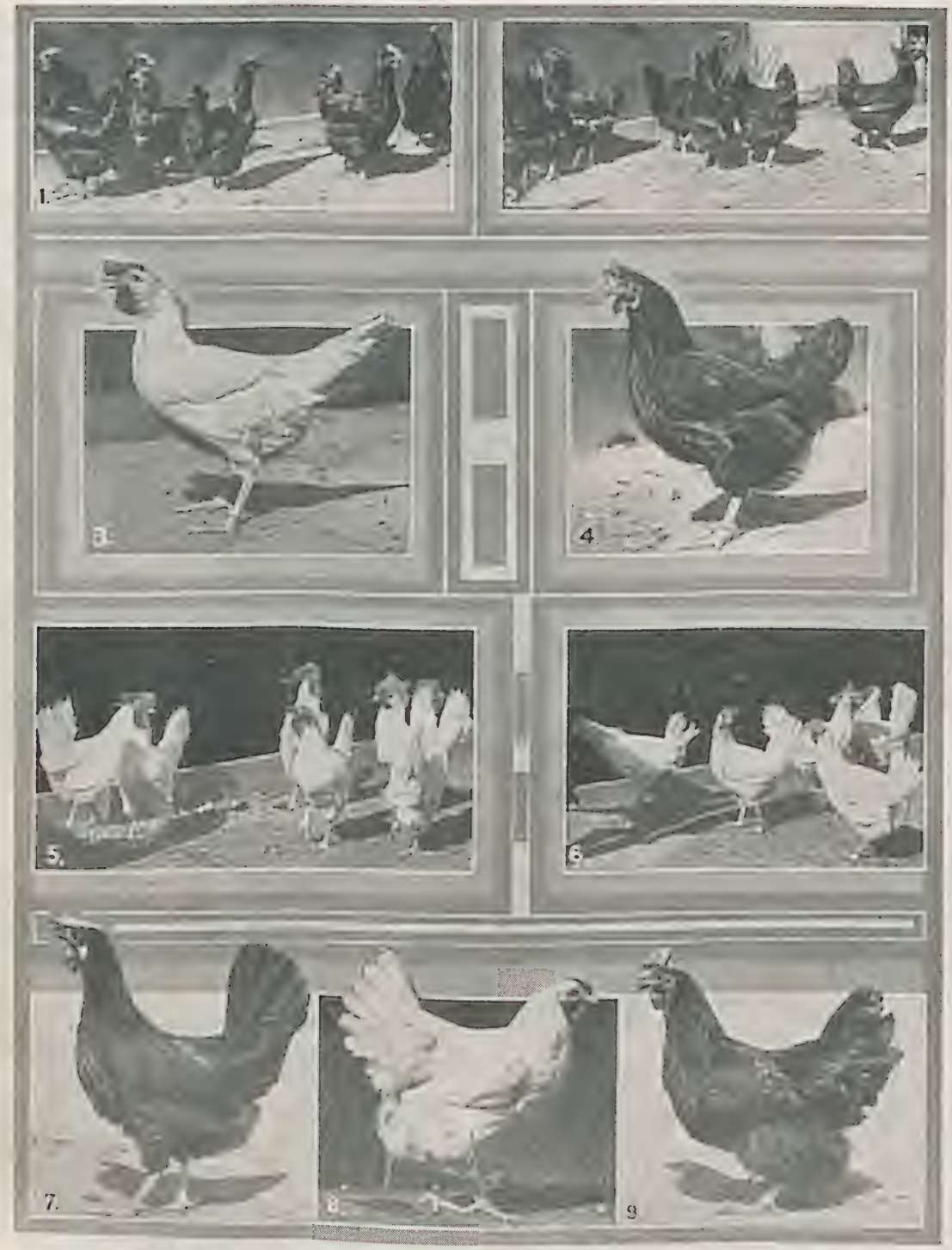
THE 22nd egg-laying competition conducted by the Department of Agriculture at Burnley, commenced on 1st April, 1932, and concluded on 2nd March, 1933—a period of 48 weeks. The number of entries received showed a substantial increase over those of the previous year, no fewer than 656 pullets competing in the two sections. Section A was contested by 70 teams, each of six birds, while 236 birds were entered in Section B, which was for entries of two birds competing in single pens. Six classes were provided for different breeds, &c., in each section. Birds in Class 2 (White Leghorns) were fed on dry mash, but the remainder were all fed wet mash.

So far as size, constitution, and stamina are concerned, the birds that competed in the year under review probably were better than those entered in any previous competition. There were no record scores, but the general average was well maintained, and in regard to size, the eggs were very satisfactory. The first three teams in the Leghorn section (wet mash) laid 3,864 eggs, of which only 58 were second grade. The winning team, owned by Mr. A. McDonald, of Burwood, laid 1,310 eggs, only nine of which were under weight. The Leghorns fed on dry mash had a slightly better record in regard to size of eggs, the 3,766 eggs laid by the first three teams including only 42 second grade.

Mr. P. N. Tilley's White Leghorn.

Some very close contests marked the single test section. In Class 2 (White Leghorns—dry mash) only one egg separated the winner and runner-up, owned respectively by Mr. T. L. Eastaugh and Mr. P. N. Tilley, while in the class for Rhode Island Reds, the two birds owned by Messrs. Farrin Webb and G. E. Rees respectively finished with equal scores—237 eggs each—all first grade.

Amongst the less popular breeds, the greatest improvement in both quality and egg produc-



1.—Enidville Poultry Farm's Australorps; 2.—J. Wrathall's Rhode Island Reds; 3.—P. Lindsay's White Leghorn; 4.—G. E. Rees' Rhode Island Red; 5.—Woodlawn Poultry Farm's White Leghorns; 6.—J. L. Edgcumbe's White Leghorns; 7.—Sorrento Poultry Farm's Black Leghorn; 8.—D. Granter's White Wyandotte; 9.—W. F. Roger's Australorp.

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tion was shown by Black Leghorns and Brown Leghorns. Class 3, for all light breeds other than White Leghorns, was won by a Black Leghorn pullet owned by Sorrento Poultry Farm with 221 eggs, all first grade; the runner-up being a Brown Leghorn owned by Mr. D. Granter.

Eggs laid throughout the competition totalled 121,945, the average per bird for the 48 weeks being 189.9. During the test the health of the birds generally was good, and many owners have since expressed appreciation of the condition in which their birds were returned.

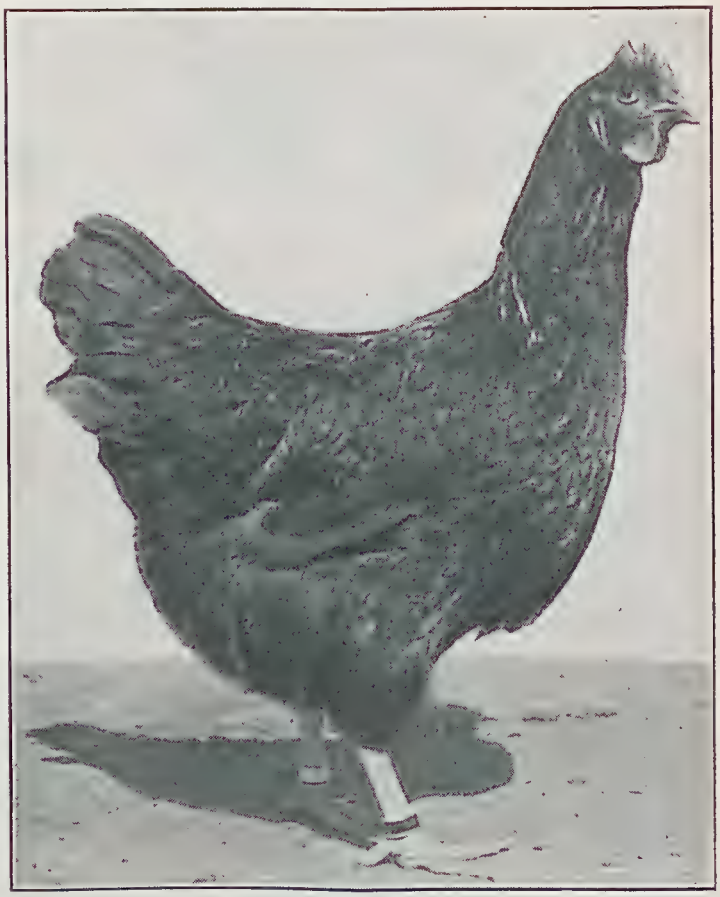
Cost of Feeding.

The number of fowls in the competition at its beginning was 656, but 36 of these died. The total number of days these latter birds collectively were in the pens was 7,505, equal to approximately 22 birds having been there for the full 48 weeks. Therefore, the total number of birds in the competition for the whole period may be regarded as 642, and this is the figure that has been used when working out averages, &c. The total number of eggs laid, including those under weight, was 121,945, an average per bird of 189.9 for the 48 weeks.

The price realized for the eggs averaged approximately 11¼d. per dozen. The market value of the eggs averaged 14s. 9½d. per bird, and the average cost of food was 6s. 7d. per bird, a fraction under 1¾d. per week; thus the profit over cost of food for the 48 weeks averaged 8s. 2½d. per bird.

The quantities of food consumed by the birds during the currency of the competition were:—Wheat, 24,684 lb.; oats, 3,687 lb.; maize, 6,351 lb.; wheat pollard, 16,784 lb.; oat pollard, 436 lb.; bran, 12,363 lb.; maize meal, 349 lb.; dried butter milk, 592 lb.; meat, 3,515 lb.; onions, 304 lb.; salt, 105 lb.; grit, 4,200 lb.; and charcoal, 415 lb.

Appended is a list of the winners of prizes, Champion and Government certificates.



Mr. Farrin Webb's Rhode Island Red.

SECTION A.—TEAMS OF SIX BIRDS, TRAP NESTED.

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Class 1.—White Leghorns—Wet Mash.			
1st Prize—Champion Certificate; also 3rd Prize—Burnley Sash.			
Woodlawn Poultry Farm (A. McDonald), Burwood-road, Burwood	1,310	9	1,301
2nd Prize—Government Certificate.			
J. A. Smith, 114 Arthur-street, Fairfield Park, N.20	1,267	5	1,262
3rd Prize—Government Certificate.			
J. L. Edgcumbe, "Nilgiris," Yan Yean-road, Plenty	1,287	44	1,243

Section A—*continued.*

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Class 2.—White Leghorns—Dry Mash.			
1ST PRIZE—CHAMPION CERTIFICATE.			
J. L. Edgcumbe, "Nilgiris," Yan Yean-road, Plenty	1,303	34	1,269
2ND PRIZE—GOVERNMENT CERTIFICATE.			
J. H. Wernli, Alpina Poultry Farm, Cheltenham, S.22	1,243	2	1,241
3RD PRIZE—GOVERNMENT CERTIFICATE.			
W. Elliott, Irymple	1,220	6	1,214
Class 4.—Australorps—Wet Mash.			
1ST PRIZE—CHAMPION CERTIFICATE; ALSO BURNLEY CHAMPION SASH.			
Enidville Poultry Farm (S. Young), 74 St. Elmo-road, Ivanhoe, N. 21	1,549	157	1,392
2ND PRIZE—GOVERNMENT CERTIFICATE; ALSO 2ND PRIZE—BURNLEY SASH.			
J. A. Naylor, 858 Heidelberg-road, Alphington, N.20	1,333	8	1,325
3RD PRIZE—GOVERNMENT CERTIFICATE.			
H. J. Hulme, Milawa, via Wangaratta	1,238	7	1,231
Class 5.—Rhode Islands—Wet Mash.			
1ST PRIZE—CHAMPION CERTIFICATE.			
J. Wrathall, 12 Dickens-street, Glen Iris, S.E.6 (Rhode Island Reds)	1,050	7	1,043

SECTION B.—INDIVIDUAL BIRDS, SINGLE TEST.

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Class 1.—White Leghorns—Wet Mash.			
1ST PRIZE—CHAMPION CERTIFICATE; ALSO BURNLEY CHAMPION SASH.			
P. Lindsay, 25 White-road, North Wonthaggi	282	..	282
2ND PRIZE—GOVERNMENT CERTIFICATE; ALSO 3RD PRIZE—BURNLEY SASH.			
T. A. Mentiplay, Somerville ..	273	..	273
3RD PRIZE—GOVERNMENT CERTIFICATE.			
Warilda Poultry Farm (T. R. Ward), 81 Pt. Nepean-road, Elsternwick, S.4	260	3	257
Class 2.—White Leghorns—Dry Mash.			
1ST PRIZE—CHAMPION CERTIFICATE.			
P. N. Tilley, Glenburne-road, Mitcham	256	..	256
2ND PRIZE—GOVERNMENT CERTIFICATE.			
T. L. Easthaugh, Pt. Nepean-road, Highett, S. 21	257	2	255
3RD PRIZE—GOVERNMENT CERTIFICATE.			
G. McDonnell, 46 Childers-street, Kew, E.4	259	10	249

Section B—*continued.*

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Class 3.—All Light Breeds other than White Leghorns—Wet Mash.			
1ST PRIZE—CHAMPION CERTIFICATE.			
Sorrento Poultry Farm, Campbell-road, Sorrento (Black Leghorn) (Correspondence to Mr. D. Kitto, c/o Baillieu Allard Pty. Ltd., 360 Collins-street, Melbourne, C.1)	221	..	221
Class 4.—Australorps—Wet Mash.			
1ST PRIZE—CHAMPION CERTIFICATE; ALSO 2ND PRIZE—BURNLEY SASH.			
W. F. Rogers, 23 Bent-street, Caulfield, S.E.8	287	8	279
2ND PRIZE—GOVERNMENT CERTIFICATE.			
C. E. Graham, Portarlington ..	262	5	257
3RD PRIZE—GOVERNMENT CERTIFICATE.			
C. E. Graham, Portarlington ..	250	..	250
Class 5.—Rhode Islands—Wet Mash.			
EQUAL 1ST PRIZE—CHAMPION CERTIFICATE.			
Farrin Webb, "Rafa," Traralgon.. (Rhode Island Red)	237	..	237
G. E. Rees, 7 Kelvin-road, Alphington, N.20 (Rhode Island Red)	237	..	237
3RD PRIZE—GOVERNMENT CERTIFICATE.			
G. D. Lockhart, 11 Blair-street, Bentleigh, S.E. 14 (Rhode Island Red)	257	25	232

FOR THE GREATEST NUMBER OF FIRST GRADE EGGS LAID BY INDIVIDUAL BIRDS IN EACH CLASS OF SECTION A.

Name and Address	Bird No.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Class 1.—White Leghorns—Wet Mash.				
1ST PRIZE—CHAMPION CERTIFICATE.				
Hughie Mitchell, "Hillsley," Eltham-road, Rosanna	84	286	..	286
2ND PRIZE—CHAMPION CERTIFICATE				
A. J. Hill, Sunraysia Poultry Farm, Greensborough	8	263	..	263
EQUAL 3RD PRIZE—GOVERNMENT CERTIFICATE.				
A. Trionfi, Brown Coal Mine, Yallourn	129	253	3	250
Mr. M. G. Occleshaw, "Lauriston," Warrandyte-road, Ringwood	71	267	17	250
Class 2.—White Leghorns—Dry Mash.				
1ST PRIZE—CHAMPION CERTIFICATE.				
J. L. Edgcumbe, "Nilgiris," Yan Yean-road, Plenty	193	252	2	250

Section A—Individual Birds—*continued.*

Name and Address.	Bird No.	Total Eggs.	Under-weight.	Total First Grade Eggs.
2nd Prize—Government Certificate.				
"Ruburina" (V. D. Wallington), Nell-street, Greensborough	209	249	1	248
3rd Prize—Government Certificate.				
J. L. Edgcumbe, "Nilgiris," Yan Yean-road, Plenty	195	242	3	239
Class 4.—Australorps—Wet Mash.				
1st Prize—Champion Certificate.				
Enidville Poultry Farm (S. Young), 74 St. Elmo-road, Ivanhoe, N.21	404	290	1	289
2nd Prize—Government Certificate.				
Enidville Poultry Farm (S. Young), 74 St. Elmo-road, Ivanhoe, N.21	408	278	9	269
Equal 3rd Prize—Government Certificate.				
Enidville Poultry Farm (S. Young), 74 St. Elmo-road, Ivanhoe, N.21	406	261	..	261
H. J. Hulme, Milawa, via Wangaratta	351	261	..	261
Class 5.—Rhode Islands—Wet Mash.				
1st Prize—Champion Certificate.				
J. Wrathall, 12 Dickens-street, Glen Iris, S.E.6 (Rhode Island Red)	298	250	2	248
2nd Prize—Government Certificate.				
W. Donovan, 24 Regent-street, Brighton, S.6 (Rhode Island Red)	277	245	4	241
3rd Prize—Government Certificate.				
H. T. Scoble, Stevens-road, Vermont (Rhode Island Red)	285	226	1	225

Note.—In Classes 3 and 6 of Section A. and Class 6 of Section B. the leading birds failed to lay the number of first grade eggs required to entitle them to a prize certificate.

SECTION A.

First Class Certificates of Merit to Teams in Classes 1, 2, and 4 which Laid 1,200 First Grade Eggs; and in Classes 3, 5, and 6 which Laid 1,000 First Grade Eggs.

Name and Address.	First Grade Eggs.
Class 1.—White Leghorns—Wet Mash.	
A. B. Craven, 36 Neville-street, Carnegie, S.E.9	1,237
A. Trionfi, Brown Coal Mine, Yallourn ..	1,235
Class 2.—White Leghorns—Dry Mash.	
"Ruburina" (V. D. Wallington), Nell-street, Greensborough	1,210

Section A—*continued.*

Name and Address.	First Grade Eggs.
Class 2.—White Leghorns—Dry Mash.	
J. L. Edgcumbe, "Nilgiris," Yan Yean-road, Plenty	226
J. H. Wernli, Alpina Poultry Farm, Cheltenham, S.22	227
W. Elliott, Irymple (2)	225 and 223
A. J. Hill, Sunraysia Poultry Farm, Greensborough (2)	221 and 220
F. M. G. Starbuck, Murray River Poultry Farm, Murrabit	232
Hughie Mitchell, "Hillsley," Eltham-road, Rosanna	236
N. Burston, Bulleen-road, Balwyn, E.9 ..	234
Sorrento Poultry Farm, Campbell-road, Sorrento	231
E. A. Watson, High-street, Doncaster ..	221
Class 4.—Australorps—Wet Mash.	
J. A. Naylor, 858 Heidelberg-road, Alphington, N.20 (3)	232, 232, and 230
H. J. Hulme, Milawa, via Wangaratta (2) ..	230 and 258
Bennett's Electric Hatchery (A. Bennett), "Winchester," Cedric-street, Ivanhoe, N.21 (3)	249, 227, and 236
S. E. R. Barker, Woodend	252
C. E. Graham, Portarlington	224
W. Higgs, Kyabram	230
Mrs. D. Mason, Mt. Evelyn, Monbulk-road, Lilydale	222
"Shawville" (H. Shaw), 15 Mayfield-street, Ripponlea, S.2	226
Broadleigh Egg Farm (L. G. Broadbent), 32 Shepparson-avenue, Carnegie, S.E.9	228
J. Wear, Werribee	245

SECTION B.

First Class Certificates of Merit to Hens in Classes 1, 2, and 4 which Laid 240 First Grade Eggs; and in Classes 3, 5, and 6 which Laid 220 First Grade Eggs.

Class 1.—White Leghorns—Wet Mash.	
Fernhill Poultry Farm (H. C. Siede), Bay-road, Cheltenham, S.22	256
Miss J. Smith, 114 Arthur-street, Fairfield Park, N.20	255
E. Edwards, Main-street, Drouin	254
Miss M. Smith, 114 Arthur-street, Fairfield Park, N.20	251
T. H. Lishman, "The Pines," Werribee ..	250
Rowlands Poultry Farm (J. R. Rowland), Clayton-street, Canadian, Ballarat East	250
A. H. Schulz, 3 Cremorne-street, Balwyn, E.8..	248
Mrs. F. E. Andrews, Weeroona-street, Box Hill North, E.12	248
J. R. Clarke, 20 Simpson-street, Northcote, N.16	248
B. Harrison, 14 First-avenue, East Kew, E.4 ..	248
*Martin and Nicholls, 23 Clonaig-street, Brighton East, S.6	247
A. May, Hewlett-road, Tally Ho	247
L. E. Mackenzie, Centre Dandenong-road, Cheltenham, S.22	246

* Bred by J. L. Edgcumbe.

Section B—*continued.*

Name and Address.	First Grade Eggs.
S. A. J. Jones, 36 Johnston-street, Newport, W.15	244
W. Bastin, 20 Ellington-street, Caulfield, S.E.8	244
T. J. Stevens, 309 Darling-street, Ballarat ..	243
J. Kay, Scotsburn-avenue, Clayton	242
T. A. Mentiplay, Somerville	242
C. R. Fagg, 76 Maud-street, Geelong ..	241
E. M. Clarke, 20 Simpson-street, South Northcote, N.16	240
Class 4.—Australorps—Wet Mash.	
Bennett's Electric Hatchery (A. Bennett), "Winchester," Cedric-street, Ivanhoe, N.21	1,224
S. E. R. Barker, Woodend	1,201

First Class Certificates of Merit to Individual Birds in Classes 1, 2, and 4 which Laid 220 First Grade Eggs; and in Classes 3, 5, and 6 which Laid 200 First Grade Eggs.

Class 1.—White Leghorns—Wet Mash.	
Woodlawn Poultry Farm (A. McDonald), Burwood-road, Burwood (3)	229, 245, and 231
J. A. Smith, 114 Arthur-street, Fairfield Park, N.20	226
J. L. Edgcumbe, "Nilgiris," Yan Yean-road, Plenty (2)	230 and 246
A. B. Craven, 36 Neville-street, Carnegie, S.E.9 (2)	225 and 237
"Ruburina" (V. D. Wallington), Nell-street, Greensborough	228
Dr. A. N. Dickson, Canterbury-road, Bayswater	226
A. J. Hill, Sunraysia Poultry Farm, Greensborough (2)	234 and 230

Certificates of Merit—*continued.*

Name and Address.	First Grade Eggs.
Mrs. M. G. Occleshaw, "Lauriston," Warrandyte-road, Ringwood (2)	221 and 220
G. Dwyer, "Karalee," Greythorn-road, Balwyn, E.9	226
Sorrento Poultry Farm, Campbell-road, Sorrento (2)	236 and 226
"Beau" (W. C. Krieger), 8 Walton-avenue, East Prahran, N.18	229
"The Don Poultry Farm" (A. J. May), Church-road, Doncaster (2)	238 and 220
Mrs. G. M. Jones, 36 Johnston-street, Newport, W.15	226
Tapscott Bros., Warren-road, Mordialloc (2) ..	224 and 225
Hicks Bros., Riverview Poultry Farm, Maribyrnong	234
Class 2.—White Leghorns—Dry Mash.	
T. J. Stevens, 309 Darling-street, Ballarat ..	248
Rowlands Poultry Farm (J. R. Rowland), Clayton-street, Canadian, Ballarat East	248
Class 4—Australorps—Wet Mash.	
J. A. Naylor, 858 Heidelberg-road, Alphington, N.20	247
J. Young, 29 Wheatley-road, Bentleigh, S.E.14	247
R. R. Christie, St. Elmo Poultry Farm. Bentleigh, S.E.14	244
F. G. Julyan, 454 Nepean-road, Brighton East, S.6	242
H. R. McChesney, Hereford-road, Mt. Evelyn..	241
G. R. Morris, 31 Primrose-crescent, North Brighton, S.6	240
Mrs. S. Kelly, Pascoe Vale-road, Pascoe Vale, W.8	240

DUCK SECTION.

In the competition for ducks the scores were not as high as usual. The winning team of Khaki Campbells, owned by Mr. M. G. Leech, laid 1,589 eggs, and the winner in the single test section, owned by Broadleigh Egg Farm, laid 317 eggs. With the exception of two Buff Orpingtons entered by Mr. Dutton, all the ducks that competed were of the Khaki Campbell breed. Eggs laid by the 40 ducks totalled 8,827, an average of 220.7 per duck for the 48 weeks of the competition. There were no deaths.

The price realized for the duck eggs averaged approximately 10d. per

Mr. M. G. Leech's Team of Khaki Campbells.

dozen. The market value of the eggs was 15s. 4½d. per bird, and the cost of food averaged 8s. 11¾d. per bird, or 2¼d. per week. Thus the profit over cost of food for the 48 weeks averaged 6s. 4¾d. per bird.

The quantities of food consumed by the ducks during the currency of the competition were:—Wheat, 26 lb.; mixed grain, 60 lb.; wheat pollard, 4,058 lb.; oat pollard, 57 lb.; bran, 2,076 lb.; maize meal, 55 lb.; dried butter milk, 14 lb.; meat, 320 lb.; salt, 7 lb.; and grit, 280 lb.

BURNLEY DUCK EGG-LAYING COMPETITION, 1932-33.

Name and Address	Total Eggs.	Under-weight.	Total First Grade Eggs.
Section A.—Teams of Six Birds—Single Tested.			
1st Prize—Champion Certificate; also Burnley Champion Sash.			
M. G. Leech, "Trevallyn," Sydney-road, Campbellfield (Khaki Campbells)	1,593	4	1,589
2nd Prize—Government Certificate; also 2nd Prize—Burnley Sash.			
Broadleigh Egg Farm (L. G. Broadbent), 32 Shepparson-avenue, Carnegie, S.E.9 (Khaki Campbells)	1,447	2	1,445
3rd Prize—Government Certificate.			
Larkie Poultry Farm (A. Ferguson), Leviston-street, Noble Park (Khaki Campbells)	1,322	1	1,321
Section A.—Individual Birds.			
1st Prize—Champion Certificate; also Burnley Champion Sash.			
Broadleigh Egg Farm (L. G. Broadbent), 32 Shepparson-avenue, Carnegie, S.E.9 (Khaki Campbell)	307	..	307
Section A—Individual Birds—*continued*.			
2nd Prize—Government Certificate.			
M. G. Leech, "Trevallyn," Sydney-road, Campbellfield (Khaki Campbell)	292	..	292
3rd Prize—Government Certificate.			
Broadleigh Egg Farm (L. G. Broadbent), 32 Shepparson-avenue, Carnegie, S.E.9 (Khaki Campbell)	291	..	291
Section B.—Individual Birds—Single Test.			
1st Prize—Champion Certificate; also Burnley Champion Sash.			
Broadleigh Egg Farm (L. G. Broadbent), 32 Shepparson-avenue, Carnegie, S.E.9 (Khaki Campbell)	319	2	317
2nd Prize—Government Certificate; also 2nd Prize—Burnley Sash.			
A. Whitworth, Grace Park, Greensborough (Khaki Campbell)	300	4	296
3rd Prize—Government Certificate.			
Broadleigh Egg Farm (L. G. Broadbent), 32 Shepparson-avenue, Carnegie, S.E.9 (Khaki Campbell)	284	..	284

Broadleigh Egg Farm's Khaki Campbell.

Potato Growing in Victoria

No. 3.—Change of Seed

By J. T. Ramsay, Potato Expert.

Previous articles of this series, which appeared in the March and April issues of the Journal, dealt with the condition and selection of seed and seed storage methods.

FOR years the changing of seed potatoes from one soil to another has been a subject for contention amongst growers. Some believe that the seed for heavy land should be secured from a crop grown on light soil and vice versa, while others consider the change from warm to cold districts beneficial. They argue that degeneration can be prevented, and disease-resistant qualities increased by such change.

These beliefs are world-wide—growers in the Southern United States have made a practice of obtaining their seed from the Northern States, while England each year looks increasingly to Scotland for her supplies.

But, however much ground the change of seed theory may have gained amongst growers, no logical reason for it has yet been given, and it might with justice be ranged with many another theory that has become dissipated with the advance of modern scientific knowledge.

It is not denied that degeneration of seed does occur, but scientific research having disposed of the change of seed theory, inclines strongly to the belief that the cause is to be found nearer home, and that seed selection is the prime factor in governing the improvement or degeneration of ensuing crops. A striking illustration of the value of seed selection was afforded some years ago by the experience of a competitor in a Victorian Agricultural Society's field crop competition for potatoes. This grower had gone to the trouble of selecting seed for 1 acre, especially for the competition, but the quantity he actually secured was sufficient to plant only three-fourths of an acre. Owing to the conditions of the competition the entry was disqualified but, at the request of the grower, a comparison was made between this area and the adjoining crop. The soil, manuring, and cultivation in each case were identical, the only difference being that one crop was planted with selected seed, while the other was planted with the ordinary run of seed from the previous season's crop. The following were the yields obtained:—

Produce from selected seed	9 tons 9 cwt. per acre.
Produce from unselected seed ..	5 tons 18 cwt. per acre.
Increased yield due to selection ..	3 tons 11 cwt. per acre.

This illustration shows an increase of over 60 per cent. in favour of selected seed, which should impress, even if it does not convince sceptics.

Another experience in support of selection of seed as a means to overcome degeneracy is that of the late Mr. Kenny, then Principal of the Orphanage, Ballarat, who, about 1890, secured a parcel of seed, and by selecting from his best plants each year, not only maintained the productiveness of this strain, but improved it during the thirty-five years of its cultivation there.

In 1914, 1915, and 1916, the Department of Technical Instruction in Agriculture for Ireland instituted tests to ascertain the grounds for the widely held belief in the necessity for a change of seed potatoes, and found that, in the majority of centres, home-grown seed produced the greatest total yield, from which the Department drew the following conclusion:—"That

where sufficient attention is devoted to the selection and treatment of home-grown seed potatoes, the frequent introduction of new seed is unnecessary, and as good crops may be obtained from seed grown in Ireland, as from imported seed."

From these tests, and the experience gained in recent years by growers who have adopted scientific cultivation and seed selection methods, it is clear that improvement in potato production may be most certainly and safely obtained by more intelligent attention to manuring, cultivation, and the selection of seed from the most sound and prolific plants. Given seed of a fair to good standard of prolificacy, and a district suited to the cultivation of the potato, there is no need for a grower to import new seed stock, provided he pays attention to the principles of cultivation and selection. The one reason why any parcel of seed gives better returns under the same conditions than another, is that the parcel producing better yields has superior virility.

The admitted fact that Scottish-grown seed, as a rule, produces heavier crops than English-grown seed, is often advanced as proof of the alleged beneficial effect of the change, but the obvious reasons for this superiority are:—(1) Because more care is taken in the matter of selection in the case of the former; (2) because the climate of Scotland permits seed to be kept in better condition between seasons than does that of England; (3) because a much greater percentage of the crops of the north is dug in an immature condition than is the case in South Britain.

The opinions of the advocates of change of seed appear to be based on a belief in the inevitable senility of plant life, but no evidence in support of this theory has yet been advanced. As an illustration of its unsoundness, the case of the Ash Leaf Kidney variety, which has been in cultivation for nearly 100 years, and still remains productive, may be cited.

Many growers ignore the fact that cultivated crops of high economic value are grown under what may be termed artificial conditions, and when the high standard of these artificial conditions necessary for the best results in production is not maintained, because of bad farming, neglect, or climatic conditions, deterioration of the particular species under cultivation must follow.

When this is more widely understood, and when it is realized that virility of seed depends entirely on careful selection and storage, then only will the Victorian farmer have seized upon the most powerful aids to increased yields.

Under certain conditions, of course, change of seed is justified. Such conditions are as follow:—

The seed may be non-productive.

It may be unsuitable for the soil in which it is grown.

It may be of a variety not desired by the buyers in the place where it is marketed.

It may be comprised of so many varieties as to render it useless for sale for seed purposes.

The crop may be grown in a climate so warm as to make it impossible, without facilities for cool storage, to carry seed over from season to season in good condition.

Importing New Varieties.

Because of the heavy yields obtained from certain new varieties of potatoes in Scotland, there are many people who advocate the importation of these varieties into Australia in order to increase yields here. Usually these people fail to appreciate the danger of introducing with such potatoes diseases not at present encountered in this country. Two such diseases affecting potato crops in Scotland, and for which no cure has yet been discovered, are black wart (*Synchytrium endobioticum*), and corky scab (*Spongospora subterranea*). These diseases are responsible for heavy losses to growers in the United Kingdom, and should they be introduced into Australia it is possible that, under the conditions obtaining here, they would cause even greater damage.

It should be remembered also that, on the average, climatic conditions in Scotland are more favorable to the production of heavy yields of potatoes than is the case in Australia, while cultivation methods generally are more thorough. These two factors account very largely for the great difference in the average yields of the two countries.

Physical Condition of the Soil.

If it is to thrive, the potato crop demands soil that is well drained, either naturally or artificially, free working, and of fair depth. Soils ranging between sandy and loamy are the most suitable in which to grow the crop, as on account of their texture they are more easily, and therefore more cheaply, cultivated into the necessary tilth than are the heavier clay soils, and they are not so likely to become set and unkind.

The freer the condition of the soil the more constant is the shape of the tubers to their type, as is instanced by the uniformly good formation of potatoes grown in soils of light sandy character, the tubers there developing without restriction. The crop may be grown in heavy clay land, but good crops are obtainable in clay soils only by the application of heavy dressings of organic manures, and by frequent and perfect tillage. But, as a rule, it is not advisable to attempt to grow these potatoes on heavy clay soils.

There is an idea prevalent amongst many farmers that new land only is suitable for potato-growing, but this is incorrect. It is quite true that some farmers obtain the best results during the first year or two of opening up virgin land, but this is due to the fact that it has been so farmed as never again to be in a proper physical condition to favour or permit a heavy yield being grown.

New land, as a rule, is permeated by a mass of grass and other rootlets, which, when the land is broken up, act helpfully towards the succeeding crop—physically, by keeping the soil open and by conserving moisture, and chemically, by supplying plant food. The fact that the potato thrives so well under these conditions clearly indicates that the invironment is suitable to it; therefore, it is but stating the obvious to say that, if good crops are to be the rule, the conditions prevailing when virgin soil is first broken up should be aimed at when preparing older worked land for the crop, and these can be attained only by adding organic matter to the soil from time to time.

Importance of Organic Matter.

Vegetable matter is the most important factor in determining the physical condition of the soil, and it should be borne in mind that the need for good physical condition is greatest where it is most difficult to retain it. In a climate such as that of Victoria where it is customary to experience long spells of dry, hot weather, it is only by the observance of good farm practice that the vegetable matter, or humus content of the soil, can be saved from incineration and maintained at an appreciably beneficial standard. Under the system followed by many at the present time, each succeeding year sees a depreciation, in both the fertility and the mechanical condition of their soils that are under cultivation. Indeed, one often hears of land that is said to be incapable now of producing as heavy crops as it once did, and of land which is said to be quite worked out.

Land that will not grow as heavy crops as ever it did is land which has been maltreated in the farming. The tendency has been to take all possible out of the soil without consideration for the future, with the common result that the humus content has been gradually reduced until frequently a state bordering on absolute depletion has been reached, and the soil thereby rendered difficult to work and uncongenial to crops—particularly potato crops.

Such a system of robbing the land may yield payable returns for a short period, but, if farming is to continue to pay, the farmer must improve the condition of his soil from year to year. It is the greatest possible mistake to allow land to become run down before attempting to check the depreciation.

If a proper system of farming, i.e., the rotation of crops, periodic green manuring, and catch-cropping—is followed, the impairment of the physical state of the soils can be prevented. In the older farmed countries of the world, a profitable physical condition of the farmed lands has been maintained only by the application of large quantities of organic matter, and, if the productiveness of the land here is to be increased or even maintained, that same procedure of ploughing in vegetable matter must be followed in order that the condition of the soil necessary for the free development of plants may be secured.

The incorporation of a plentiful supply of organic manure with the soil increases its capacity for the absorption and retention of moisture, thus providing a regular supply for the wants of the potato crop during the period of growth.

This is a considerable factor in reducing the risk of second growth.

The Sheep Industry

Helpful Hints to Sheep-men

10.—The Hand-feeding of Sheep.

[Previous articles of this series, which appeared in the June, July, August, September, November, and December, 1932, and January, February, and March, 1933, issues of the Journal, dealt with the selection of ewes and rams, lamb marking, classing the wool clip, fat lamb raising, the sheep blowfly, foot-rot, worms, liver fluke disease and infectious eye disease.]

THE question of feeding sheep during periods of drought or semi-drought is one that recurs at intervals in Australia. Unfortunately, most people wait until the drought comes before commencing to consider what should be done in the way of providing reserves of fodder to tide their stock over this period. The object of this article is to direct attention to the need for making such provision and to set out the various fodders suitable for hand-feeding in drought periods, together with the approximate cost of maintaining sheep on each of the fodders dealt with. The experiments on which the conclusions are based were carried out at the Central Research Farm, Werribee, some time ago by Messrs. J. E. Thomas, B.Sc., B.Agr.Sc., B.V.Sc., and N. A. Bowman, sheep and wool expert.

Weighing the Sheep in Hand-feeding Experiments.

It is not proposed to discuss here the question of pasture improvement, but rather to draw attention to the need for the cultivation of fodder crops where possible and the conservation of fodder to enable a larger number of sheep to be carried over the lean months of the year.

The carrying capacity of sheep lands depends not on the growth of pasture in the flush period of the year, but rather on the number of sheep that can be carried over a dry summer and autumn. It is the quantity of feed available at this period of the year which determines absolutely the carrying capacity the year round. Though there may be sufficient food over the greater part of the year to carry two sheep per acre, the limit of safe stocking may be less than one sheep to the acre—the carrying capacity at the leanest period of the year. It follows then that, if we can increase the carrying capacity during these few months of each year, the carrying capacity of the farm for the whole of the year is correspondingly increased.

The most practicable method available for this is to supplement the pastures during the lean period by hand-feeding. Of course, such a proposal is one that requires very close investigation. The most important factor is that of cost. It is obvious that the practicability of adopting any method of hand-feeding

depends primarily on whether it will be a profitable commercial proposition or not.

The experiments referred to above were designed to show the actual food requirements of dry sheep, and the cost of maintaining them for lengthy periods. The results obtained should serve as a guide to farmers in determining whether it would pay them to supplement their pastures by hand-feeding in the lean period, so that a greater number of sheep could be carried throughout the year. They should serve also to indicate the actual cost of carrying sheep over the severe dry spells occasionally experienced in almost every district.

For these tests 60 comeback wethers, rising 4-tooth, Riverina bred, and August-shorn, were ear-tagged, and divided into three lots of twenty each. Three paddocks, each an acre in extent, were fenced off, and provided with feeding troughs and straw rack, a water supply, salt lick, and shelters. The weighing arrangement consisted of a race leading from a crush pen to a crate, with doors at each end, fixed on a platform scales, so that all unnecessary handling was eliminated.

The yards were thoroughly eaten down before the sheep were weighed in. The following uniform procedure was adopted in regard to weighing:—The sheep were fed at 6.30 a.m. on the day previous to weighing, and fed immediately after being weighed, on the following day, at 9 a.m.

The rations used included the fodders most commonly fed in Victoria, and were as follow:—(1) Algerian straw, alone; (2) Algerian straw and oats; (3) Algerian straw and linseed; (4) Algerian straw and lucerne hay; (5) oaten silage; (6) chaff (mixed oaten and wheaten).

Straw was always available, and was fed from racks; the other fodders were fed from troughs, daily, at 8 a.m.

In these trials, there was no noticeable difference in the health of the various pens of sheep; it was uniformly good throughout, with the exception that one sheep in the "straw alone" pen died following on faulty nutrition, and another sheep in the "straw and oats" pen died from natural causes. The pen fed lucerne and straw always looked particularly well. There were no apparent digestive troubles in the pens fed dry feeds solely.

At the end of the experiments the wool of the sheep was certainly light conditioned, and well grown and sound. After the trial, they were run on good pastures for four weeks, and were then shorn. An average cut of 10 lb. per fleece was obtained.

Examining the data presented in the accompanying tables, it will be seen that, in the first trial (Table 1) straw alone was insufficient to maintain a dry sheep.

TABLE 1.—SHEEP FED ON ALGERIAN STRAW ALONE.

Dates of Weighing.	Mean Live Weight Twenty Sheep.	Average Amount of Straw Consumed Per Day.
	lb.	lb.
April 21	88·4	..
May 5	89·4	1·71
„ 19	86·2	1·15
June 3	84·3	1·50
„ 15	81·6	1·54
„ 29*	81·4	1·13

* One sheep died.

In this particular experiment the straw used was of high quality, being dry season straw. The problem of maintenance is the supply of sufficient flesh-forming elements or protein, and it is here where straw fails. That there is a fair margin in the quality of straw is indicated by the fact that Algerian dry season straw used in the experiments contained 2.9 per cent. of protein, whereas flaggy straw grown on irrigated land contains 1.9 per cent. of protein. It is the quality of the straw that determines the quantity consumed, and the amount of supplement required for maintenance.

TABLE 2.—SHEEP FED ON STRAW AND LINSEED.

From 29th June, the straw ration (Table 1) was supplemented by a daily ration per head of linseed, as shown below:—

Date of Weighings.	Mean Live Weight Eighteen Sheep.	Linseed Nuts.	Weight of Straw Consumed Per Day.
	lb.	oz.	lb.
July 9	84·3	4	1·37
„ 16	85·2	4	1·155
„ 30	84·1	4	1·20
August 11 ..	84·7	4	1·09
„ 19 ..	89·4	4	1·42
„ 27 ..	90·4	3	1·44
September 3 ..	90·8	3	1·48
„ 11 ..	90·3	3	1·35
October 2 ..	94·0	3	0·80
„ 14 ..	91·6	2	1·16

Of the supplements tested, linseed 3 oz. per day, lucerne ½ lb. per day, gave very satisfactory results. The accompanying graph clearly indicates the loss of weight suffered when the sheep were fed on straw only, and the gain when linseed was added to the ration.

TABLE 3.—SHEEP FED ON ALGERIAN STRAW AND LUCERNE HAY.

Date.	Average Live Weight Twenty Sheep.	Straw Per Head.	Lucerne Hay Per Head.
	lb.	lb.	lb.
April 21	87·8	..	..
„ 28	91·6	1·0	0·5
May 5	91·1	·75	0·5
„ 19	88·8	·75	0·5
June 3	86·5	·72	0·5
„ 11	86·5	·98	0·5
July 2	86·7	·94	0·5
„ 9	88·9	1·18	0·5
„ 16	88·7	·97	0·5
„ 30	89·3	1·08	0·75

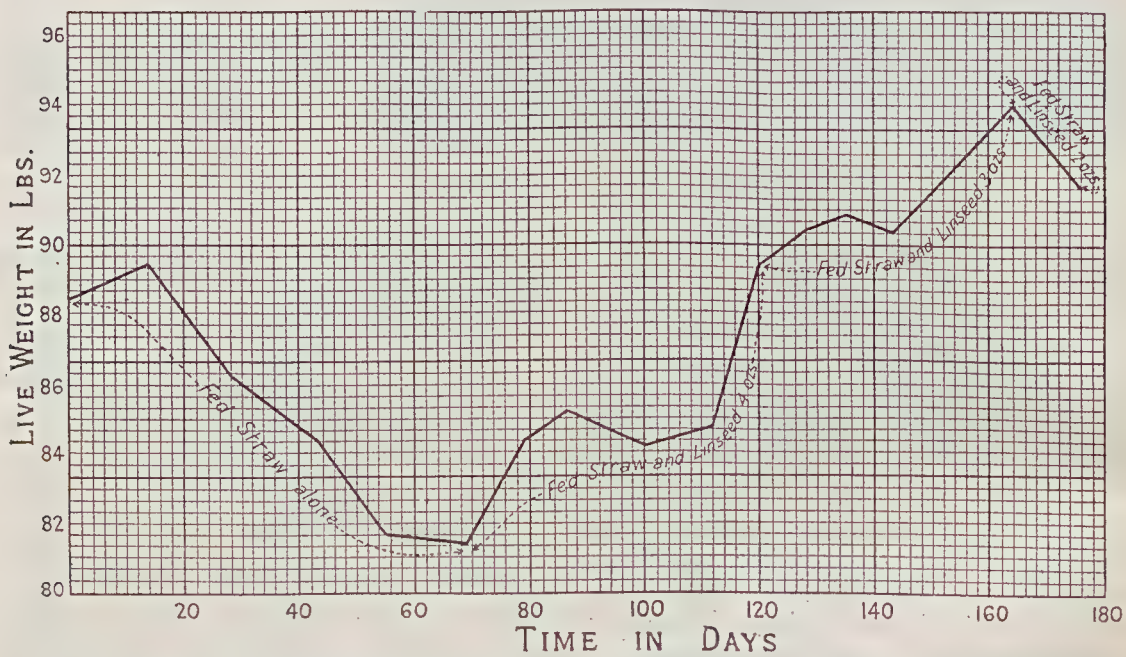
In the pen in which oats were fed (Table 4), the sheep consumed considerably less straw than those in the adjoining pens. It seems from the figures that ½ lb. oats per day is scarcely sufficient, there being loss in live weight of 5 lb. per head when on an 8-oz. ration. An ample ration would be straw *ad lib.*, and oats at the rate of 9 oz. per head per day. Lucerne hay (Table 3) gave very satisfactory results, and it is interesting to note that lifting the lucerne ration from ½ lb. to ¾ lb. per head per day in the last fortnight resulted in an immediate increase in live weight.

TABLE 4.—SHEEP FED ON ALGERIAN STRAW AND ALGERIAN OATS UNCRUSHED.

Date of Weighing.	Mean Weight Twenty Sheep.	Straw Consumed.	Oats Per Head.
	lb.	lb.	oz.
April 21	83·1	..	..
„ 28	86·5	1·5	6
May 5	87·2	·65	6
„ 19	84·9	·70	6
June 3	82·9	·66	6
„ 15	81·6	·75	6
July 2	81·5	1·02	6
„ 9	81·6	·78	8
„ 16	81.75	·86	8
„ 30*	80.9	·68	8
August 11 ..	81.1	·68	8

* One sheep died from natural causes.

The chaff ration (Table 5) similarly gave good results when fed at the rate of 1½ lb. per



Graph showing loss of weight of sheep when fed on straw alone and gains and fluctuations in weight when varying amounts of linseed were added to ration.

head per day. Silage also gave satisfactory results—there being a gain of 6 lb. in live weight over the experimental period where, approximately, 3 lb. of silage per day was fed. (See Table 6.). A bare maintenance ration of silage would probably be 2½ lb. per head per day.

TABLE 5.—SHEEP FED ON CHAFF, MIXED OATEN AND WHEATEN.

On termination of the trial with Algerian straw and lucerne hay (Table 3), the sheep in that pen were fed on a chaff ration as follows:—

Date.	Average Live Weight Twenty Sheep.	Chaff Per Head Per Day.
	lb.	lb.
July 30	89·3	1·80
August 11	93·0	1·50
„ 19	91·8	1·50
„ 27	94·4	1·50
September 3	91·7	1·50
„ 11	92·2	1·50
„ 30	93·6	1·50
October 14	94·9	1·50

At the conclusion of the trial with Algerian straw and oats (Table 4), the sheep used in that test were fed on a silage ration with the results set out in Table 6.

TABLE 6.—SHEEP FED ON OATEN SILAGE.

Date of Weighing.	Mean Weight Eighteen Sheep.	Silage Per Head Per Day.
	lb.	lb.
August 11	81·1	..
„ 19	80·6	3·0
„ 27	82·4	2·8
September 3	81·7	3·0
„ 11	82·9	3·0
October 2	88·4	3·0
„ 14	87·2	2·0

The fodders used were fairly similar in composition to those in general use in Victoria. There were some marked differences in the protein content of the various straws and in the composition of the silage, due, in the latter case, to the stage in which the silage was. The differences, however, were not significant enough to limit the experimental conclusions.

In considering the nutritive requirements of sheep, there are several factors to be considered: the live weight, wool (fine-woolled or otherwise), climatic conditions, and finally, whether the sheep are "wet" or "dry."

In general, in stating rations the food requirements are set out in terms of live weight (per 1,000 lb.), and calculations are made accordingly, i.e., a 100-lb. wether would require five-sixths the amount of a 120-lb. wether.

The effect of weather conditions is very important. These particular trials were made in a mild winter, and consequently the fodder requirement figures are higher than if the trials had been carried out in the warmer months. The figures must therefore be regarded as a maximum.

Animals on a maintenance ration only are very much affected by weather conditions—particularly the temperature. This is not nearly so marked when an animal is fed liberally, since, in digesting the greater bulk of food provided, enough heat is generated to keep the body warm. On limiting the food supply, however, the amount of heat generated is correspondingly reduced, and, when the air temperature falls below a certain point, is not sufficient to keep up the body temperature, with the result that the sheep must burn up its own tissue to maintain the body heat. It will, therefore, lose weight, and to prevent such loss it is necessary to increase the ration. This is confirmed, to some extent, by the figures below, indicating the fluctuations in live weight of three pens of sheep when on a standard ration under different average minimum temperatures:—

Date.	Weight.	Mean Minimum Temperature During Period.
August 27	89·0	36·7
September 3	88·0	35·2
„ 11	88·4	41·7
„ 30	92·0	46·3

The temperature below which the food requirements markedly rise is termed the critical temperature, and is about 50 deg. F. It has been estimated that below this point the food requirements rise at the rate of 5 per cent. for each 2 deg. F. It would seem, therefore, that the figures obtained under the conditions of the experiments at the State Research Farm are from 10 to 15 per cent. higher than if they had been carried out during the warmer

months when the air temperature was much above the critical temperature.

In considering maintenance, it is not strictly correct to define a dry sheep as being non-productive. Every sheep is growing a fleece of wool, and as wool contains about 16 per cent. of nitrogen, the sole source of which is the protein in the food, it is necessary to supply an adequate quantity of protein over and above the bare needs of body wear and tear.

There is a lack of definite knowledge of the requirements of ewes-in-lamb as against dry sheep, though some experimental work in Western Australia* would indicate that ewes-in-lamb can be carried in a strong healthy condition during the warm months of the year—March, April, and May—with a mean minimum temperature of 57 deg. F. on a ration supplying, per 1,000 lb. live weight, 0.5 lb. of crude digestible protein, with a nutritive ratio of 1-12, and a total of 10 to 15 lb. dry matter, and also that ewes can be carried in a thriving condition on 0.70 lb. digestible protein (nutritive ratio 1-12) per 1,000 lb. live weight. The former amount approximates to the rations fed to dry sheep in the State Research Farm experiments, during the colder months, with an average minimum air temperature of 45.5 deg. F. For ewes the ratio should not be wider than 1 to 14, and for this reason wheaten or shandy chaff alone (N.R. 1-17 to 1-19) is not in itself sufficient.

The extra demands of the ewe for additional nutrients to support the unborn lamb are not very large until close to lambing time, when the need arises for additional protein to stimulate a good milk flow. Succulent foods are then also of great benefit. Very much mortality in lambs could be avoided, and a much faster rate of growth would be obtained if the impoverished pasture at or about lambing time were supplemented by some concentrated food, so that a good milk flow might be induced.

From a perusal of the figures shown in the following table, it will be seen that the costs will vary considerably according as the fodders are home-grown or purchased. Taking the figures in the table alone as a basis, it is easy to compute the cost on the farm of rations made up from any of the foods mentioned.

The striking point is the low cost of feeding on silage, thus disproving the prevailing idea

Costs of Maintenance Rations Based on the Trials.

Comeback Wethers—Live Weight 80-90 lb.

Daily Ration.	Price.	Cost of Ration.
1. Algerian straw, 1·0 lb. Algerian oats, 9 oz. ..	£3 10s. per ton 3s. 3d. per bushel	·92d. per day, 6½d. per week
2. Algerian straw, 1·25 lb. Lucerne hay, ·5 lb. ..	.. .. £7 5s. per ton	·84d. per day, 6d. per week
3. Algerian straw, 1·5 lb. Linseed nuts, 3 oz. ..	.. .. £14 per ton (2,000 lb.)	·86d. per day, 6d. per week
4. Oaten silage, 2·5 lb. ..	£1 per ton..	·28d. per day, 2d. per week
5. Chaff (mixed oaten and wheat), 1·5 lb.	£6 10s. per ton	1·03d. per day, 7¼d. per week

In tabulating the above rations, the quantities have been based on the trials, the figures being modified to what was considered to be the exact requirement for maintenance. An allowance of 15 to 20 per cent. waste in straw was made. Owing to market fluctuations, the figures are of relative value only. They may be less where the farm values of home-grown fodders are considered, or more where the landed cost includes market price, plus freight. In the case of silage which has no market value, the production cost is taken, which at Werribee is £1 per ton for a 5-ton crop grown on fallow, and ensiled in an overhead silo.

that the sole place of the silo is on the dairy farm. Silage may be preserved indefinitely—in fact, in the Riverina ten to fifteen year old pit silage is common. It is not only cheaply made, but also possesses the additional merits of succulence, and freedom from the ravages of mice, &c. In the rations specified in the table, roughage is supplied by the Algerian straw, and on the average farm its equivalent might be the straw stacks, the stubble, or any dry picking. These experiments show that where such roughages are available, good supplementary foods for 85-lb. wethers are linseed 3 oz., lucerne ½ lb., or oats 9 oz. The point, therefore, arises—which is the cheaper for any particular case? In Victoria, the grain most commonly used is oats, due to the fact that it is usually reasonable in price, and pays better when fed to stock than when sold as grain. There is now an increasing supply of oats, as its value as an integral part of crop rotations is being recognized. Where freight is concerned, linseed possesses many advantages, being, as it is, an extremely concentrated food containing usually 28 to 30 per cent. protein, and 8 to 10 per cent. oil. Lucerne is very valuable, but it is always necessary to get good

* Bulletin No. 87—"West Australian Sheep Feeding Experiments," by Sutton and Vanzetti.

quality hay with a minimum amount of stalk. It is extremely palatable, and therefore there is usually little waste.

In feeding hay to sheep the problem arises —is it better to feed it as such in racks, or to chaff it? Even if properly designed racks are made, there is usually some waste, which may be up to 10 per cent. The value of this waste, however, would still be less than the cost of chaffing and bagging of hay under normal conditions. But when the price of hay begins to rise, then chaffing may be justified where there are no feeding racks. In chaffing for sheep, it is necessary to cut as short as possible.

Methods of Hand-feeding.

Many expedients have been adopted in times of stress. In timbered country, logs may be placed about 15 or 16 inches apart, and bags tacked between. A space of from 12 to 15 inches per sheep should be allowed. Satisfactory bag troughs can be made by threading wire through bags placed end to end. The wires should be strained about 15 inches apart; a 6-inch sag at the bottom should be allowed. Supports about 1 foot high should be driven in every 9 feet to hold up the edges of the troughs. These troughs should be placed in a sheltered position so that they will not be blown about by the wind. A wire passed along the bottom of the trough will help to prevent this. Another wire should be strained above the middle of the trough to prevent the sheep from jumping into or across the trough. Wooden troughs should be made about 9 in. wide at the bottom. Galvanized iron may be bent up to make satisfactory troughs. On bare ground, linseed and grain may be broadcast with little waste, though trough feeding is desirable. In feeding hay or straw, racks are necessary to reduce waste. Wire netting (2½-inch mesh) is useful for making racks. In constructing wooden racks, there are two principles to be considered—firstly, they should be fairly straight-sided, so that straw, &c., will not fall down into the wool; secondly, they should have a fair capacity so as to cut down the labour involved. A suitable size is one 6 feet high, 2 feet 6 inches wide at the bottom on the ground, and 7 feet wide over all at the top. The rack slats 3 inches by 1 inch can be spaced from 5 to 6 inches apart.

Unquestionably the ideal method of feeding chaff to sheep is by means of the self-feeder. With it there is practically no waste; the weaker sheep fare better, and the labour is reduced to a minimum.

In constructing self-feeders, there are several principles to be observed:—(1) A self-feeder should be of ample capacity to ensure that the labour of filling is reduced to a minimum; (2) the roof should project over the trough to keep off the rain, and so ensure that the chaff will not be blocked by being wet; (3) the feeder must be placed in a sheltered position so that the wind will not whirl out the chaff. To avoid this latter loss, which may be a very serious one, it is advisable to extend the ends of the feeder past the troughs, and so keep the wind out. Self-feeders are not fool-proof, and it is always advisable to make daily inspections to see that the feed is running freely. The diagram on the next page shows an outline of the type of self-feeder in common use.

Principles of Hand-feeding.

1. Duration of Hand-Feeding.

It is essential to commence hand-feeding early, to carry it out thoroughly, and not to terminate it for some time after the grass has had a good start. Hand-feeding should never be delayed until the sheep begin to lose condition. If condition be lost, and the sheep be put on unusual foods, there may be serious losses owing to the weakening of the constitution, and the consequent inability of the digestive organs to assimilate the unaccustomed foods.

2. Ample Water Necessary.

It is always necessary to have ample water close at hand when feeding on dry foods, for long trips for water are very weakening. At times in parts of Victoria where the water obtained from bores is highly mineralized, the amount of salt in it may be excessive, and lead to kidney troubles due to the formation of calculi. Though the exact tolerance of sheep for the different salts in the water supply is not definitely known, observations made by the chemist's branch of the Department of Agriculture would indicate that water containing up to 300 to 400 parts salt per 100,000 is quite suitable; water containing from 400 to 1,000 parts should be used for short periods only, and water with more than 1,000 parts per 100,000 should not be used at all, except perhaps only for very short periods in cases

of dire necessity. The latter strength corresponds to about 1½ oz. of salt per gallon of water.

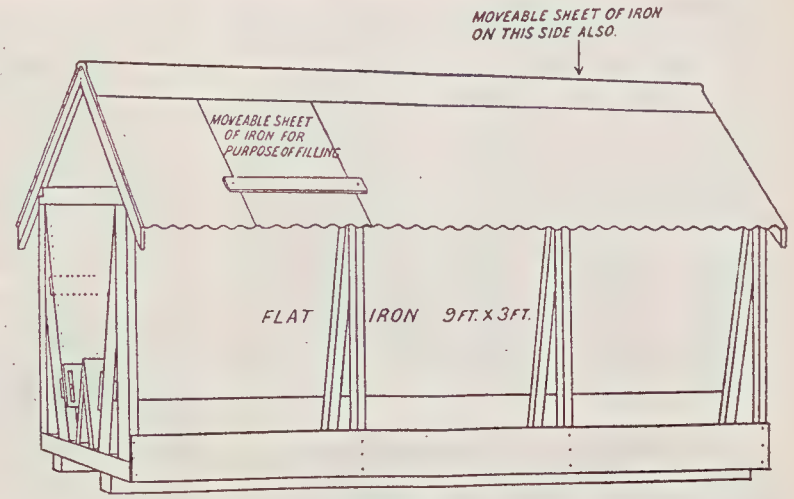
3. Supply of Salt Necessary.

The supply of plenty of salt is also necessary. In the experiments conducted at the State Research Farm, the average amount consumed per day per sheep was 0.19 oz., or approximately 1.33 oz. per head per week, or, roughly, 4½ lb. of salt per year. Of course, these figures might not hold in the case of sheep on natural pastures. For wet sheep, it has been found that the salt requirements are considerably greater.

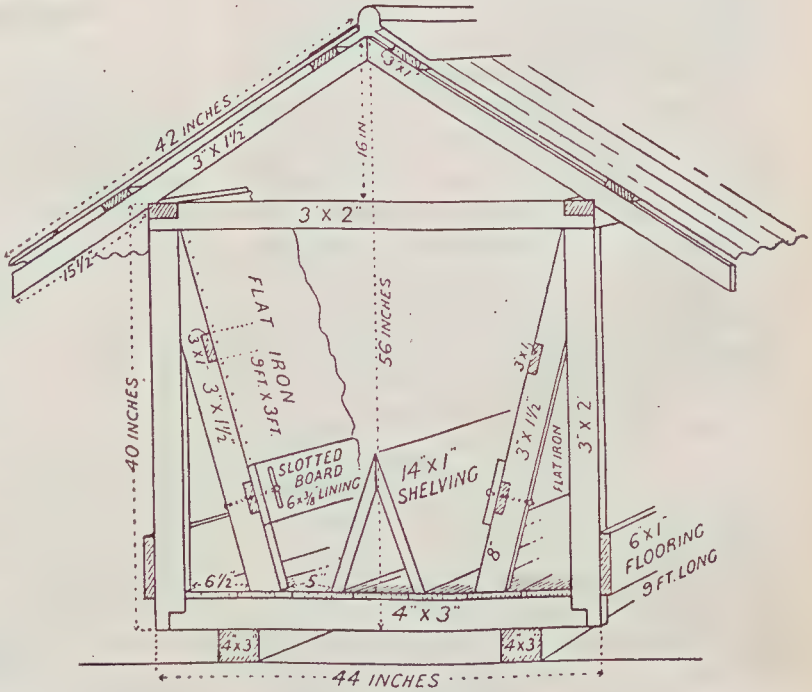
In New South Wales, where scrub is cut for emergency feeding, a laxative lick containing 5 to 10 per cent. of Epsom salts is recommended.

4. Some Variety of Foods Necessary.

When feeding for lengthy periods, it is found that mixed foods give better results than obtained from the prolonged use of single foods. With mixed foods the ration is better balanced, and they have a greater palatability. With a variety of fodders, there is always less danger of the sheep "going off" their food. In New South Wales, however, when lucerne hay was fed at the rate of 3 lb. per day to 85-lb. merino wethers, it was found that, on this ration, they could be maintained for a year without any ill effects, though much better results were obtained with a ration of lucerne and maize. Owing in part to its greenness, lucerne hay is very palatable, and this, coupled with the fact that it was fed liberally, gives the probable explanation.



Side View.



End Section.

A satisfactory type of self-feeder.

Mixing foods also supplies some balance between the bulkier and the more concentrated foods. The roughages are necessary to give enough ballast for the digestive organs to function properly, whereas the grains and

[Continued on page 249.

Pasture Improvement

A summary of a Progress Report on the Investigations initiated in 1932 by the Department of Agriculture in co-operation with the Victorian Pasture Improvement League.

EARLY in 1932 a contract was concluded between the Department of Agriculture and the Victorian Pasture Improvement League, which provided that, in consideration of the provision by the league of adequate funds over a period of three years, certain pasture investigations should be carried out by the Department in accordance with a scheme mutually agreed upon. Under this scheme the Department was to preserve independence in the administration of its staff and the direction of their work, and accept full responsibility for the reports issued by it.

The work which was to be carried out necessarily had to be restricted at first to the dairying districts of southern Victoria, because of the limited funds and the shortage of departmental staff. The scope of the work comprised—

(*a*) Manurial trials to determine the primary response of the various pastures to dressings of different artificial fertilizers.

(*b*) Manurial grazing trials to determine the cumulative response of the pasture to manuring and grazing.

(*c*) Sown down areas to ascertain the value of the various mixtures, species, and strains of grasses and clovers in different localities.

(*d*) Systematic surveys of pastures and pasture types and the determination of their relation to soil type, climate, and other controlling factors.

(*e*) An economic survey of dairy farms to ascertain as far as possible the influence on labour income of improved pasture management practice.

(*f*) The conduct of suitable demonstrations of the results by means of field days, &c., as the information becomes available.

The programme was commenced in the autumn of 1932, and so far has consisted mainly of the field trials designated under the first three headings. Two types of experimental plots have been established—(1) *pilot plots,* observational in character, designed to record outstanding responses to manurial treatments and to determine the pasture species likely to be of most value under local conditions; and (2) *major plots,* these being larger and more comprehensive in scope, including (*a*) quantitative manurial trial areas, the growth on which is cut at intervals and weighed; (*b*) manurial trial areas, intermittently grazed with stock; and (*c*) pasture mixture areas for trials of various species of pasture plants, and the different strains of such plant species.

Thirty-five areas for the pilot plot series and eleven for the major plot series were selected in Gippsland and the Western District. The plots were laid out and field work, involving fencing, water supply, and preparatory cultivation, was commenced immediately, and the seeding of all sown areas and the manuring of the pilot plots were completed during the autumn. The establishment of the grazing trials was then proceeded with, and the whole plan was brought into operation before the spring.

The plots have been inspected regularly throughout the year, and records kept of the germination, early growth, and development of the sown mixtures and species. Observational records have also been made of the manurial responses showing on the pilot plots. On the major plots accurate measurements have been made of the growth of grass on the mowing manurial trials and the number of grazing days obtained from the manurial grazing areas has been recorded.

Summary of Results.

(a) Manurial Trials (Mowing and Observation Plots).

Although it may be permissible to comment on the action of readily soluble quick-acting manures, it is as yet early to attempt to draw conclusions from the action on the pastures of the more slowly soluble fertilizers. Generally the response to the different manures has varied greatly from plot to plot, and only in the case of the spring dressings of nitrogenous manure has there been anything like consistency throughout all the areas treated.

Nitrogen.—It was found to be impracticable to apply the autumn dressing of sulphate of ammonia provided for in the plan, but on almost every plot the early spring dressing of sulphate of ammonia on established pasture produced a short, sharp increase in growth and a marked improvement in the colour of the pasture. While this increase in growth on established pasture was not prolonged over any extensive period, in one or two instances the application of a dressing of 1 cwt. per acre of sulphate of ammonia to a newly-sown pasture resulted in a marked improvement in the sward established. This is particularly noticeable in the case of the Heywood and Birregurra pilot plots.

Potash.—On some of the Western District mowing plots potash has given definite small increases in yield which have been well sustained throughout the spring. Until December no material increases were observed from its use in the Gippsland plots.

Lime.—On several plots the use of lime has been attended already by considerable increases in growth, but in most of the districts this material has not produced any observable increase. It is as yet early to expect results from these lime (as also the potash) dressings, and it is possible that it will not be until the coming winter that the greatest benefit from lime dressings will be seen.

Superphosphate.—Very striking increases in growth have been obtained on many of the plots from the use of superphosphate. These increases, which were obtained on both the pilot and major plots of Gippsland and the Western District, were well sustained throughout the spring. In several cases, however, the use of superphosphate did not prove of any material benefit.

In this regard it should be remembered that in a number of instances the experimental areas were on pastures which had been regularly top-dressed in the past years. Consequently it would hardly be expected that on such land the phosphoric acid content of the soil would be so low as to produce striking results on further top-dressing with superphosphate.

Ephos Phosphate.—The use of this slowly soluble phosphate has not yet produced any appreciable increase in yield, and the plots treated with this manure have been in every respect similar to the unmanured strips.

Blood and Bone.—While the plots treated with this material have not made as good growth as those treated with superphosphate, they have usually shown an improvement over the unmanured strips.

(b) Manurial Trials—Rotational Grazing Plots.

Early in the spring the nitrogen treated plots showed a much better growth and colour than did the plots treated with superphosphate alone, but only a small increase in grazing was obtained from them. So far the manures do not appear to have had any permanent effect on altering the botanical composition of these plots. The manured plots had more vigorous growth of clover than the unmanured plot, but the proportional composition of the plots has not yet been materially changed.

Weed Growth on Sown Down Plots.

As might be expected, the plots have experienced very diverse conditions of weed growth, and whilst some of them were almost entirely free from weeds, others have been bady infested. Over the bulk of the plots weed growth has not been very troublesome, but in a few cases where the ploughing of pasture land brought buried weed seeds to the surface a dense smother crop of weeds was produced. The plots at Port Fairy, Cudgee, and South Ecklin were particularly bad in this respect. Fortunately, many weeds do not recover well from cutting in the late spring, and by means of mowing at this stage the weed growth has been greatly checked.

The weeds encountered on light soils comprised aira, breeza, sorrel, loosestrife, the annual trefoils and bartsia, and on the plots in damp situations, carex, juncus, docks, loosestrife, bent grass, suckling, and white clovers.

On the plots where these weeds are bad the growth of the sown pasture plants has been checked as much by the soil conditions as by the weed growth, and these restrictions on growth must be recognized as limitations imposed by the environment.

Sown Section Pasture Mixtures and Strains.

Throughout the seeded plots of the Western District the outstanding feature has been the successful establishment of the perennial rye-grass. On practically all plots it has become the dominant species. Cocksfoot also has made a most promising establishment, and should prove a useful constituent of the mixtures. The position in the Gippsland plots is similar, except in the hill country where the cocksfoot has become a very strong competitor to the rye-grass. Prairie, crested dogstail, chewings fescue, brown top, and Yorkshire fog have made good headway on most of the plots in which these species were included. Phalaris tuberosa and Timothy have been successfully established on most areas, but as yet they do not contribute any material proportion of the bulk of feed. Red, alsike, white Dutch, and subterranean clovers have become well established on most of the plots, while lotus hispidus and strawberry clover have made satisfactory headway in only a few plots. Lucerne, although it germinated well and made vigorous seedling growth, failed to develop, and is now absent on most plots.

The sections of the major plots sown to the various strains of rye-grass generally have made good growth, and should afford some excellent comparisons of the value of the different strains under different local conditions. The annual and false perennial types of rye-grass made very vigorous growth during the winter and early spring, and were more readily grazed by the stock than were the perennial types. In the late spring, however, the recovery from grazing was slower than in the case of the perennial types, and they failed to show the sward forming characteristics which are so prominent in the long-lived types. Probably many of them will die out during the trying summer weather.

Strips of sulphate of ammonia applied across the sown areas at the rate of 1 cwt. per acre seldom showed any improvement at all in assisting the establishment of the pasture. Neither was the growth nor colour of the treated portions improved.

Permanent Pasture Mixtures (*continued from page 216*).

Many farmers like to include in the above four mixtures for heavy rainfall areas such temporary elements as the following:—

		s.	d.
Italian or Wimmera rye-grass ..	4 lb. at 4½d. per lb. ..	1	6
New Zealand cowgrass	2 lb. at 1s. 6d. per lb. ..	3	0
Alsike	2 lb. at 1s. 3d. per lb. ..	2	6
	8 lb. per acre. Cost =	7	0

The object is to secure more feed quickly the first season, and better summer growth during the first summer or two. Thus temporary elements may be useful if included in moderation. But it should be remembered that both Italian and Wimmera rye-grass are highly competitive while they last, and likely to suppress slow-growing plants such as cocksfoot and white clover.

The mixtures given are intended only as a general guide to those in doubt as to what grasses and clovers to sow down. Special plants such as Phalaris tuberosa, Paspalum, crested dogstail, Timothy, Lotus major, and the like, have been excluded from the discussion because of their unsuitability for general purpose requirements. The prices also are approximate, but conform reasonably closely to those ruling at the moment for seed of high quality.

Consideration of the subject of pasture establishment could scarcely take place without reference being made to the desirability and importance of top-dressing. The phosphatic requirements of young crop plants such as the pasture species are very high, and vigour and health are influenced by the presence of a readily available supply. The rate of application of superphosphate varies from 90 to 180 lb. per acre, according to the nature of the soil and the rainfall. Unfortunately, in these times of economic stress, farmers are not always able to top-dress their pastures as liberally as they would do otherwise, and in this connexion purchasers are reminded that the Commonwealth bounty on purchases of superphosphate may be applied for on forms available at country post offices.

Tongala Irrigated Farm Competition

Report of the Judges, Messrs. L. C. Bartels, B. Agr.Sc., Senior Irrigation Officer, and J. MacFadyen, State Rivers and Water Supply Commission.

THE 1932-33 Farm Competition conducted by the Tongala Agricultural Society was particularly successful, and the exhibits were of ever higher standard than in previous years.

The history of the competitions has been one of continued progress, and they have been an effective means of improving methods throughout the district. Credit is due to Mr. J. Barrett, of the State Rivers and Water Supply Commission, for his part in organizing this competition.

The attractive homestead of Mr. J. Pederick.

Two inspections of the farms and pastures were made, the first at the beginning of December and the second in March. Entries in the lucerne competition were judged separately at the end of January.

All the competitors deserve commendation in some regard. The layout and subdivision of the blocks, improved fertility, steady progress in the establishment of permanent crops, and the building up of improved herds attracted attention in nearly every case.

The possibilities of intensive farming are revealed in the descriptions of the winning farms; the consistently high production from Mr. Hanslow's farm has been reported previously. Mr. Makin fattened 1,000 sheep on 45 acres during the season, while Mr. T. Gass, who kept a record of the production from 4 acres of his pasture, obtained 46½ days grazing for 28 milking cows, 3 dry cows, and a bull, from October to March. This was equivalent to 2 cows per acre for 6 months. The milk yield for the period was 826 gallons per acre, and 300 lb. of butter fat. The production on the farms of Messrs. Duck and Bullingham is of the same high order.

All the competitors are paying greater attention to hand feeding their cows in winter, some starting as early as mid March. Where lucerne is available this fodder is favoured for hay reserves, but every year more meadow hay is being gathered—this marks the trend of development. Only one exhibitor, Mr. Coombes, had made any silage. He had ensiled the produce of 7 acres of grasses and clovers, the crop being cut at the end of October when the grasses were in flower. The pit filled is 9 feet in diameter and 12 feet deep. This pit was filled at the end of the second day, but the material kept sinking, and more was added every day for nine days till it steadied at 8 feet above the ground. It is to be hoped that silage making will extend. Good pasture management requires that the surplus growth in spring should be removed or waste will result, and the making of silage permits its harvest at a stage which ensures a better aftermath.

A few farmers sow a small area of imphee about Christmas time, and this is reserved for winter feed being cut as required. Although

there is a tendency to decry subterranean clover discerning settlers acknowledged its great productivity in winter, and one farmer with abundant mixed pasture testified that his cows had never milked so well as they did on subterranean clover last winter.

Mr. H. Hanslow's farm was awarded first prize. Since the beginning of the competitions at Tongala Mr. Hanslow has always been well placed on the award list, and at all times his block commands attention for its excellent condition and the large number of sheep it carries. He is a sheep farmer—raising fat lambs.

The farm is in two sections—the home block containing 96 acres and an adjoining area of 80 acres which was acquired in July, 1927. Mr. Hanslow has a water right of 154 acre-feet, and usually pays for some excess. The original block is subdivided into 16 paddocks and one devoted to homestead and orchard, while the second block is in 12 paddocks. Practically the whole area is under cultivation. This year there was 55 acres of lucerne, 17 acres of mixed pasture, 5 acres of Hawkes Bay rye grass, and 5 acres of sudan grass. The extra area of 80 acres is in Wimmera rye grass and subterranean clover.

At the first inspection in December the farm was carrying 744 Merino and crossbred ewes and 633 lambs which had been dropped between April and October. At the time of the second inspection in March there were 880 ewes (some with young lambs), and in addition 160 weaners —500 had been sold at the beginning of March.

Mr. Hanslow prefers fine woolled crossbred ewes, although a big proportion of his present flock is Merino. Border Leceister rams are preferred, as the Border Leicester-crossbred lambs shear well. Lincolns, Dorset Horns, and Shropshires have all been tried. The rams are put with the ewes in October, but in the past this early mating has not availed much—the bulk of the lambs arriving in June and July. This year, however, without any change in his practice he is favoured with an early drop. Last year the lambing percentage was over 100%, but footrot amongst the ewes resulted in the loss of 10% of these lambs. Hitherto Mr. Hanslow has put off prime heavy weight lambs, which would average 40 to 50 lb. dressed weight.

When weaned the top lambs are drafted off and given the first grazing. The seconds follow and then the ewes—each lot remaining on a lucerne paddock for about three days. If the lucerne gains on the sheep the mower is used. The lucerne is watered after the grazing and again in ten days or a fortnight. The ground takes about 3 inches of water. Usually 10% of the lucerne is ploughed out each year, and oats sown in the autumn, but after two years, during which a complete eradication of the old lucerne is achieved, and two crops of oats alternating with two crops of sudan grass have been grown, lucerne is resown in the autumn. Customarily Mr. Hanslow grows a cover crop, but the land is becoming so fertile that these crops grow too abundantly and smother the lucerne. Last year, for example, 21½ tons of hay was cut from 5 acres.

In sowing the sudan grass after oats, the paddock is cultivated and watered. It is cultivated twice with the spring-tooth, harrowed, and 15 lb. of sudan grass seed is sown with super. at the rate of a bag per acre. Usually the crop is grazed when knee high, but sometimes grazing has been deferred till the crop was 7 or 8 feet high.

Some of the old lucerne paddocks have been cultivated and sown with mixtures of grasses and clovers, but the white clover, &c., sown in good lucerne have been completely smothered.

All the lucerne paddocks were sown last year with Wimmera rye grass at the rate of 1 bushel per acre. This has proved highly successful, and in future this will be sown instead of oats and barley as hitherto. Sheep ate the rye grass readily. This change in cropping practice means that costs will be reduced, and more time will be available for attention to stock.

Mr. Hanslow maintains that every paddock of lucerne re-established has been better than the first, but he insists that there must be complete removal of the old lucerne. He uses a disc plough, as a moulboard does not do the job properly.

The extra area of 80 acres has been converted by Mr. Hanslow from a much neglected block to a very productive one. In the reclamation of the area oats were sown first, then sudan grass: This was followed by three crops of oats in succession, the Wimmera rye grass and subterranean clover being sown with the third crop of oats. This was a failure, but more seed was sown in the following autumn in the oats stubble, and the pasture was successfully established.

Last year the block was given one watering in March. In May there was too much feed for sheep, and 130 cows were put in for 16 days, then 744 ewes for the lambing season—these were shifted to a fresh paddock every day.

Footrot was prevalent, and, after trial of many forms of treatment, foot bathing in bluestone solution has been adopted. Every 15 days the sheep are driven through about 40 feet of troughs in sections with 3 to 4 inches of copper sulphate solution, made by dissolving 1½ lb. of crystals in 4 gallons of water. Bad cases have their feet pared, and are treated with formalin. The trouble was kept in check while regular treatment could be followed. Every sheep was handled, and the cost, including foot dressing, worked out at three baths for a penny.

Mr. F. Pattison's Ayrshires in picturesque surroundings.

The lucerne paddocks receive one bag of super. per acre, and the winter pastures have been given 120 lb. in the last two years.

Mr. G. Duck, who gained second highest points, farms an area of 115 acres. This includes an extra area which is not yet properly developed, but is rapidly taking shape as a result of the application of the methods which have brought the old block to a very high standard. At the inspections nearly every paddock bore a profusion of pastures in fresh and vigorous condition. There was a reserve of 60 tons of meadow hay. On the home block 19 acres of pasture was sown, and an area of 31 acres has developed naturally in old lucerne paddocks. Some 9 acres was in oats last year, and the balance of the area was a dry paddock and the homestead block. Fourteen acres of pasture has been sown on the new block, and there is 21 acres of old lucerne and pastures sown before Mr. Duck took possession.

At inspection, this farm was carrying 38 milking cows, two dry cows, three 2 year-old heifers, ten yearlings, 19 poddies, one Freisian bull, and six horses. Pigs kept included five crossbred sows, two British black sows, a large Yorkshire boar, three stores, and 47 young ones from slips to baconers.

Last year Mr. Duck used 181 acre-feet of water on 90 acres in 2½ inch waterings. He applied 10 tons of superphosphate in giving a uniform application of 2 cwt. of super. to most of the block. He considers an annual dressing desirable, and applies the manure in May and June. Under test 27 of his cows averaged 355 lb. butter fat without allowance, and 34 cows brought in a gross return of £720.

Mr. J. Bullingham's farm now has an area of 67 acres, including 23 acres recently acquired. It is subdivided into 15 paddocks, and is sown down as follows:—22 acres of lucerne, 7 acres of oats, 1½ acres of fallow, 10 acres in natural grass, and the balance in perennial mixed pasture.

Nearly 2 feet of water per acre was applied last year on the old block, and 6½ tons of super was used in giving a dressing of 4 cwt. per acre to the pasture, and 2 cwt. to the lucerne. The herd test returns from 26 cows showed an average yield of 404 lb. of fat, and 22 of these averaged 428 lb. Mr. Bullingham's cows are all the progeny of the same bull, and were produced from a mixed herd. His top cow last season gave 508 lb. of butter-fat. The cows were dehorned, and have given increased production as a result.

To Mr. Bullingham every year's results bring greater conviction of the value of superphosphate, and he asserts that the carrying capacity of his pasture was increased by 50% last year. His belief in pastures is confirmed by his experience, and wild white clover, he considers, a big factor in successful pasture culture. Cows will eat it close to the ground—but Mr. Bullingham does not favour close grazing.

For eight months ending 4th March, 1933, the butter-fat production was 6,775 lb., for which he was paid £367 0s. 11d. For the corresponding period of last year the production was 5,653 lb., worth £330 18s. 10d.

Mr. J. J. Nihill has a model farm of 40 acres. It is subdivided into 12 paddocks—well fenced and conveniently set out for sheep. Originally the whole area was under lucerne, but he has now five paddocks, totalling 18 acres, under pasture, and his objective is to sow the whole area in mixed grasses and clovers.

During the last two years Mr. Nihill has bought ewes with lambs at foot. He favours Border Leicester crossbred lambs dropped early, but he experiences difficulty now in procuring an early drop. Last year 50 acre-feet of water was used on the block, and one bag of superphosphate per acre was applied.

Mr. N. J. Pederick's farm deserves special mention, because in practically every feature there is evidence of good management. There is a very neat house garden; the milking shed and dairy are models of neatness, and the lucerne and pastures were in good condition. Last year nearly 2 feet of water per acre was used on this farm of 55 acres, and one bag of super. per acre was applied to the whole area. There are 27 acres of lucerne and 25 acres of pasture. Mr. Pederick prefers the pasture for grazing his milking cows. His herd is of mixed types, and includes 27 milkers, four springers, and 26 heifers from poddies up to 2-years-old. These young stock follow the cows in a system of rotational grazing.

Farm buildings include a big shed with twelve bails on each side, and the cows are fed through the winter twice a day, 50 tons of lucerne hay being consumed by 30 cows between 1st April and the end of July. The shelter and easy availability of the feed benefits the cows.

Detailed awards are shown in the accompanying table.

Lucerne Competition.

The lucerne competition attracted a moderate number of entries. Although judging was carried out at the end of January not many competitors managed to present their lucerne crop at the best stage.

Lucerne was the basic crop in the development of the Tongala district under irrigation, but it is now being supplanted by mixed pastures. It is desirable to have some lucerne, but the experience of farmers generally is that it does not last long when planted on a piece of ground for the second time in succession. However, Mr. Hanslow's experience recorded below is of interest, and much of the lucerne in the competition, includng the winner's crop, represented a second sowing.

Mr. L. Moulden, whose exhibit was a particularly good young stand, maintains that on

TONGALA IRRIGATED FARM COMPETITION 1932-33.

Name of Competitor.	General lay out of Ground for Irrigation, and conveniences for handling Dairy, Herd, Sheep, or Orchard.	Percentage of Land under Cultivation.	(Dairy Farm)—General Condition of Stock.	(Sheep Farm)—Provision for Shelter, Shade, and Water.	(Orchard)—General condition of Trees or Vines.	Control of Water and state of Irrigation Channels.	Conservation of Fodder.	Provision of Artificial or Green Manures.	Pigs and Poultry.	(Sheep Farm only)—Any commercial side lines.	Any commercial side lines	Fences.	Cultivation and care of Farm or Orchard.	Farm Building.	Freedom from Weeds.	Care of Implements.	General appearance of immediate surroundings of Dwelling.	Total.
Possible points	55	40	20	20	20	30	30	30	20	25	5	20	20	20	20	15	15	
Hanslow, H.	44	38	..	14½	..	26	30	25½	..	16	..	17	18½	18½	17½	14	11½	291
Duck, G.	45	36	17½	..	..	25	28½	27	14	..	..	17	17½	18	17½	12	12	287
Bullingham, J.	49	34	18	..	..	25	29	29	7½	..	2	18	18	15	17	11½	12	285
Nihill, J. J.	49	38½	..	16½	..	27	25½	23½	..	9	..	17½	18½	17½	16½	13½	11½	284
Pederick, N. J.	48	38	15	..	..	26	27	24	8	..	3	17	18½	18½	18	14	15	(290 – 10) = 280
Makin, P.	45	35	..	..	17	25	25	26	10	..	5	18½	16	16	16½	12	13	280
Coombes, T. A. P.	48	33	18½	..	..	23½	27	25	9	..	4	17	16	17	16	12½	12½	279
Pattison, F.	43	37	18½	..	..	25	28	20	10	..	..	17	17	18	17	12	13	275½
Burbury, A. R.	45	38	..	..	16½	24	24½	26	5	..	5	17	16½	15	17	12	13	274½
Woollard, C.	45½	37	..	15	..	24	24	16	..	21	..	15	15	17½	16	12	13	271
Tinning, W.	43	34	18½	..	..	23½	27½	24	3½	..	5	16½	16	18	15½	12	8½	265½
Andrews, W.	47	36	17	..	..	24	23	20	9	..	..	15	15	18	16	12	12½	264½
Musslewhite, S.	48	27	18	..	..	23½	27	25	8	..	2	16	18	14	16½	11	10½	(264½ – 10) = 254½

NOTE.—Ten points were deducted from the aggregate of any competitor whose herd was not under test.

a good soil there is no difficulty in re-establishing lucerne.

Mr. L. Willmer's winning exhibit of lucerne was 3 acres in area. Previously the paddock was in lucerne for many years, and five years ago the land was fallowed and sown with wheat in the following year. A self-sown crop developed in the next year. The paddock was ploughed in July, 1931, and sown in October, 12 lb. of seed per acre being broadcast. It was "watered-up" and 1 cwt. of super. was applied in July, 1932. This procedure did not conform to approved methods, but inspection showed a nice crop of lucerne very dense in part but shading off towards the eastern boundary. It was just in the right condition for cutting.

Substantial fodder reserves on the farm of Mr. T. Gass.

Tongala Lucerne Competition.

Name of Competitor.	Lay out of Ground for Irrigation Condition of Channel and Drain.	Estimate of Yield at time of Inspection.	Quality of Hay Crop would Produce.	Uniformity of Stand.	Freedom from Weeds.	Total.
Possible points ..	20	20	20	20	20	
Willmer, L. ..	18½	20	18½	18	18½	93½
Hanslow, H. ..	19	14½	19	16	18½	87
Gass, T.	18	16	18	16½	18½	87
Pederick, N. ..	18	17½	16½	16½	17½	86
Moulden, L. ..	17½	13	19	17	17	83½
Makin, P.	18	11	18	16	18	81
Pattison, F. ..	17½	8	18½	17½	17	78½
Craig, J. E. ..	18½	8½	15½	16½	18	77

Pasture Exhibits.

The winning exhibit in the pasture competition was an area of 6 acres exhibited by Mr. T. Gass. In the summer of 1929-30 this land grew a crop of sudan grass, and after preparation it was seeded in July, 1930, with the mixture recommended by the Department, with the addition of an extra 2 lb. of cocksfoot per acre, while 2 acres received extra New Zealand certified rye-grass. At sowing time a bag of super. per acre was applied. In 1931 the pasture received two bags of super. per acre, and in spring, 1932, another bag per acre was applied. The land has been watered fortnightly in the hot weather, and ordinarily it is grazed for a week and rested for three weeks.

The pasture, at inspection, was in fresh and vigorous condition. It showed a good mixture of grasses and clovers, and rye-grass was conspicuous, particularly where the New Zealand seed was sown.

Pasture Competition.

Name of Competitor.	Lay out of Ground for Irrigation Condition of Channel and Drain.	Condition of Herbage.	Variety in Mixture.	Uniformity of Sward.	Freedom from Weeds.	Total.
Possible points ..	20	20	20	20	20	
Gass, T.	17½	18	18	17	19	89½
Duck, G.	18	18	17	17	18	88
Bullingham, J. ("A" exhibit)	18	18	18	17½	16½	88
Pederick, N. ..	18	17	17½	16½	18	87
Bullingham, J. ("B" exhibit)	17½	17	18	16½	17½	86½
Pattison, F. ..	18	16½	17½	17	16½	85½
Coombes, T. ..	17½	16	17	16½	17½	84½
Brose, R. ("A" exhibit)	17½	16	17½	16½	16½	84
Rowlands, E. ..	17	16½	17	17	16½	84
McCluskey, T. ..	17½	17	17½	15½	16½	84
Caldecott, R. ..	16½	17½	17½	16	16	83½
Musslewhite, S. ..	15½	16½	17½	16½	17½	83½
Brose, R. ("B" exhibit)	17½	16½	17	15	16½	83½
Burbury, A. ..	15½	12½	17	15	17	77

Para-botulism in Cattle

By R. N. Wardle, B.V.Sc., Veterinary Officer

THE disease, para-botulism, is referred to also as "botulism," and until about ten years ago was known by the term "impaction paralysis," a name which was a combination of two of the symptoms noticed by stock-owners, veterinarians, and other observers. Our present knowledge leads us to believe that a number of cases of this disease in which death occurred within a few hours of the onset of the illness, thus precluding evidence being gained of the more chronic symptoms, was not recognized as being related to cases of "impaction paralysis."

Nature and Cause.

Para-botulism is due to a poison or toxin developed by the specific germ or microbe, *bacillus para-botulinum*. This poison is produced only when the microbes are growing, and multiplying rapidly, and it is interesting to note that only under certain conditions can growth and multiplication take place. The microbe persists in dust, soil, and litter as a spore, and grows only in decomposing vegetable or animal matter in an absence of oxygen.

In some part, at least, of all decaying material, the oxygen content is exhausted by moulds and certain bacteria present; and if the spores of the *bacillus para-botulinum* be present, they will quickly grow, multiply, and produce their toxin under the most favorable conditions. Later, should conditions be unsuitable, growth of the organisms may cease, but the poison remains in the material. Cattle eating such material are certain to become affected within three to seven days. The two common sources of the poison by which cattle become affected are damaged fodder, and bones or other portions of a carcass.

Sources of damaged forage are—

(1) Mouse damaged hay, chaff, or grain.
(2) Mouldy or musty tops, and butts of stacks.
(3) Winnowed material, left in heaps in paddocks.
(4) Material in the bottom of exposed feed troughs and boxes.
(5) Old rough pastures, generally of a tussocky nature.
(6) Bone chewing.

Undoubtedly a predisposing factor in the cause of para-botulism in cattle is the bone chewing habit, due in almost all cases to the fact that the cattle are getting insufficient

Cow with Para-botulism. Note the expression of the head, with protruding paralyzed tongue.

quantities of some of the essential mineral elements, namely, calcium and phosphorus. These are present in bones in the form of calcium phosphate, and the animal instinct is such, that in order to make up for the deficiency in the diet, bones are sought for, and are chewed and swallowed.

Symptoms.

It is difficult to state what is the first symptom. Several stock-owners have stated that the first they have noticed is a stiffness in the action of the front legs, but it is probable that earlier than this there would be

a difficulty in gathering food, together with a general lassitude and drowsiness. Slobbering at the mouth takes place, and sometimes there is a watery discharge from the nose. Rumination or chewing the cud ceases, and the stiffness in the gait increases to an unsteadiness in walking.

There is naturally a very evident falling away in condition, and this is emphasized by the flattening of the usually well-sprung posterior ribs. The breathing is shallow with no movement of the chest wall, but simply shows as a fluttering of the flank muscles.

Soon the beast can neither eat nor drink, or can drink only with difficulty, and finally it goes down, and is unable to rise.

The average case may linger from three to five days, but more acute cases occur, and with such death may take place in a few hours. The symptoms in these acute cases would be sudden paralysis and coma.

The paralysis most commonly noticed is, of course, that of the muscles of the limbs, but it must be remembered that the muscles used in the acts of gathering food, of swallowing, of stomach and bowel movement, and of breathing are also affected in some degree.

Post-mortem Appearances.

These vary according to the length of the illness. In acute cases, little abnormality will be noticed in the carcass, but if the beast has been drenched, some evidence of the drench having "gone the wrong way," may be seen by its presence, and perhaps even that of some food, in the wind-pipe and bronchial tubes.

In longer-standing cases in which a drench has not been swallowed correctly, there may be a definite pneumonia evidenced by a portion of the lung being solidified, and by the presence of a frothy septic discharge in the bronchial tubes.

In the average case there invariably is a large amount of food present in the paunch; if the beast had not been able to drink for some days, the condition of this food both in the paunch and in the bible is drier than normal, which condition was one of the factors by which the disease, now named para-botulism, or simply botulism, was earlier known as impaction paralysis. This so-called impaction is more correctly termed a stagnation of food, and is due to the paralysis of the muscles of the digestive canal. In many cases a piece of bone has been noticed among the paunch contents. Any decaying food that may have been the cause of death would very likely not be recognized even if still present. Often a bolus of food is seen in the back of the mouth, although it may be positively known that no food has been eaten for many hours, or even days.

In cases that have been drenched early in the illness, but which have died subsequently, the intestine, unlike the stomach compartments, contains very little ingesta.

Treatment.

Frequently in cattle a lethal dose of the poison may be swallowed, but on account of the arrangement of the digestive system in ruminants, it is probable that the poison is distributed through the large amount of food held in the paunch, hence absorption of it all may not take place at once, and if it be possible to remove any unabsorbed poison, it is probable that the patient will recover.

It is advisable to administer a small quantity of water, and if this be swallowed, then proceed to treat with a purgative drench, such as—

Epsom salts—1 to 1½ lb.
Bicarbonate of soda—4 oz.
Treacle—½ lb.
Water—1 quart.

Every care should be taken, and the drench given slowly. If the patient be unable to swallow, a drench can be given only by artificial aids. There are two means of doing this, which are as follow:—

(*a*) Stomach tube.
(*b*) Trochar and canula.

(*a*) As an improvised tube 5 feet of ½-inch hose may be used. To insert, first construct

Cattle Probang or Stomach Tube, with Gag.

a wooden gag to fit as a bit across the mouth; bore a hole in the centre large enough to take the tubing, and with the gag in place, and the cow's head and neck held straight, pass the tube through the hole in the gag, and over the back of the tongue into the gullet. After it enters the gullet it should be possible to feel it there with the hand, manipulating the left side of the neck just above the wind-pipe.

A length of approximately 4 ft. 6 in. of the hose should be inserted, a funnel attached and the drench poured in.

(*b*) A trochar and canula is inserted into the rumen at the left flank at a point equidistant from the last rib, the point of the hip, and the edge of the loin bones. The trochar is then withdrawn, and the drench poured in through a funnel. Neither of these operations is as easily performed on the recumbent paralyzed beast as on one not so affected, therefore the services of a veterinarian should be obtained, where possible.

If there be no veterinarian in the district, the following further treatment may be given:—

Potassium nitrate	1 oz.
Sodium salicylate	1 oz.
Nux vomica	3 oz.
Ammonium carbonate	4 oz.
Linseed meal	3 oz.

Mix and divide into twelve powders. One powder to be mixed with treacle just before use, and pasted into the mouth three times a day.

To sustain the patient, sloppy and liquid foods, such as gruels and milk, may be given as long as the animal is able to take them.

Control.

(1) Prevent access to any mouldy, rain, or mouse-damaged fodder.

(2) Gather up and burn all bones, or other portions of carcasses of any animals, including rabbits.

(3) Feed a good mineral food to prevent the bone-chewing habit.

The formula of the non-iodized mixture recommended by the Department is—

Stock salt	60 lb.
Boneflour	30 lb.
Sulphur	5 lb.
Epsom salts	3 lb.
Sulphate of iron	1 lb.
or	
Stock salt	75 lb.
Di-calcic phosphate	15 lb.
Sulphur	5 lb.
Epsom salts	3 lb.
Sulphate of iron	1 lb.

Of recent years, owing to the response to recommendations from this Department to all stock-owners to use mineral food for stock, this disease has decreased to a remarkable degree. Unfortunately, however, the mouse plague last autumn caused large numbers of cases of para-botulism in stock in the northern districts, and although horses were more particularly affected then, it is considered that this is one of the chief reasons why, at the present time, there are more cases amongst cattle than have been reported for the past few years.

Readers interested in this disease will find an article on para-botulism in horses in the August 1932 issue of this *Journal*.

A Common Horse Ailment

Grass Seeds in the Mouth

By R. N. Wardle, B.V.Sc., Veterinary Officer

HORSES frequently suffer from the effects of penetration of grass seeds into the gums, tongue, and floor of the mouth, the results usually being much more serious than might be imagined. Apart from the irritation and pain to the horse, serious loss will occur to the owner by the loss in condition and consequent inefficiency of a poor-conditioned horse.

Grass seed penetration without any other factor operating will cause a horse to lose condition quickly, and it is a well-known fact that it takes far longer to build up an animal's condition than it took for the condition to be lost. Poor condition means lower vitality and, especially in the case of young horses, such lowered vitality means that the resistance to other complaints, such as worm infestation, strangles, &c., is lower than it might be.

This grass seed trouble occurs mainly in the drier months of the year, but where horses are stable-fed all the year round they may be affected at any time. In farm horses the grass seeds come both from the hay and chaff and from the grasses in the pastures. Seeds and awns of barley grass, wild oats, and the various spear-like grasses cause the original trouble. They collect in the gums at the base of the incisor, bridle, and molar teeth; in the tongue at the junction of the anterior motile part, and the thick, firm, so-called root of the organ; and again in the floor of the mouth beneath and at the sides of the tongue.

Symptoms.

These collections of awns and seeds naturally irritate the gums and lining membranes, and set up a stomatitis or inflammation in the mouth. If unrelieved, ulceration occurs and goes on until quite large wounds are present, and, collecting around a molar, they may be the means of loosening the tooth.

The wounds caused then become means of entrance for disease-producing germs, and not uncommon results are abscess formation in the glands and tissues between the jaws, and infection with consequent thickening of the jaw bones themselves. Another sequel may be the formation of a cancerous-like growth on the lower jaw, between the incisor teeth and the base of the tongue. This is actually excessive healing or granulation tissue. If unattended, these conditions, brought about by grass seed, may eventually heal, leaving a series of grooved or wrinkled scars. In these cases it is found that the horse is readily affected at subsequent times, as the wrinkles so easily collect grass seeds.

Unfortunately, owing to lack of attention and forethought on the part of horse-owners, grass-seed trouble is often unnoticed until in an advanced stage, when the affected animals are low in condition, and a "slobbering" from the mouth gives a clue to the seat of the trouble. This slobbering, unlike that which occurs through the teeth being faulty, may be noticed apart from when the animal is eating, and consists of saliva and mucus hanging in strings from the mouth.

To more observant or careful horse-masters, failure of appetite and the presence of grass seeds around the incisor and bridle teeth, probably seen when the bit is being put in the mouth, would suggest further investigation of the condition of the mouth.

Treatment.

The first thing to do is to remove the cause of the trouble. In the early stages this can be done without any artificial aid by simply extracting the awns and seeds with the fingers; attending firstly to the incisor teeth by retracting the lips; and, secondly, to the tongue by standing in front of the horse, grasping the tongue in the left hand, turning it up in the mouth, and then working to extract the seeds with the right hand. The turning up of the tongue in the mouth keeps the horse's mouth open. A pair of surgical forceps is a great aid, and for a more thorough inspection and manipulation a gag is necessary. The procedure, of course, must be repeated daily.

(*Continued on page 249.*)

Vineyard Tillage

Deep Winter Ploughing

By F. de Castella, Viticulturist

IN a properly established vineyard the four factors of fruitfulness are: correct pruning; thorough tillage; adequate manuring and disease control. Each of these is important, but none more so than tillage.

In nine cases out of ten disappointing results in the commercial vineyard will prove to be due to want of proper attention to the working of the soil.

The need to work the soil is very generally admitted, but opinions differ rather widely concerning the timing and nature of the different cultural operations. One school recommends superficial culture, consisting of oft repeated surface scratchings, only a couple of inches deep, whilst another holds for winter ploughing to a depth of 8 or 9 inches followed by spring and summer working to a somewhat shallower depth. An interesting controversy between these two schools raged in Europe some thirty years ago. Each school ultimately proved correct in its views, but under widely different conditions of climate.

Winter Ploughing of a Sultana Vineyard at Red Cliffs.

Depth of ploughing—about 9 inches; an additional furrow has yet to be ploughed on each side, thus reducing the strip between the vines in the row.

Superficial culture gives excellent results in cool climates with ample rainfall, but under our hotter and drier conditions the time honoured deep tillage of warm southern Europe is the only safe practice.

It should not surprise that in moister regions the vine gives its maximum yield when tillage is reduced to mere surface scratching, and free development permitted of its natural root system, which establishes itself largely, quite near the surface. Thus the roots function under optimum conditions of abundant plant food, for the surface soil is richer than the subsoil. In addition, conditions as to temperature and aeration are more favorable. But in warm climates with scanty rainfall, we cannot safely allow our vines to establish themselves in the natural way, since adequate soil moisture cannot be thus ensured. The roots near the surface would suffer during a dry spell. Even under irrigation, in the interval between two waterings, the surface soil may become too dry for their normal functioning. For reasons of moisture conservation, it is essential that a dust mulch of some 6 inches in thickness be maintained. Hence, it is to our advantage to artificially modify the natural root system, sacrificing those roots near the surface, and deliberately cutting them, once a year, by a winter ploughing executed to a depth of 8 or 9 inches. Strange though it might appear, this root cutting is quite harmless, provided it be carried out in winter when the vine is dormant. During the active growing period, from just before the spring-sprouting, onwards,

interference with the roots is harmful and fraught with serious consequences to the fruit crop. But the dormant vine tolerates even extensive root mutilation.

Even subsoiling every interval, to a depth of 2 feet, does not injure the vine, provided the work be done in winter. On the contrary, it has a decided rejuvenating effect on worn-out old vines, owing to the formation, near the cut ends, of young roots, collectively more active than the part removed. It is also well known that root pruning may render more fruitful, vines and fruit trees that make too exuberant growth.

The complete vineyard tillage cycle comprises deep winter ploughing, followed by shallower spring and summer workings. Before dealing with the former, the season for the execution of which is approaching, let us consider briefly the spring and summer cultivation, concerning which there is less disagreement. All admit the value of frequent working to a fairly shallow depth. This maintains the tilth established by the winter ploughing, and keeps the surface loose and free from weeds in summer. After rain or irrigation the dust mulch must be re-established and maintained.

Winter cultivation must be deep and it must be early. It can be commenced as soon as the grapes are vintaged. The vine has finished its season's growth, and does not then resent root cutting. The advantages of an early start are many. In a very wet winter it sometimes happens that the soil is unfit to plough in July and August. In September root cutting is no longer harmless, and the deep ploughing has either to be abandoned for that season or injury done to the vine. Had it been executed in May, or even in April, all roots within 9 inches of the surface would have received their annual trimming, so that subsequent workings could be effected, without risk, at any time.

Another reason for omitting the deep winter ploughing is the sowing of green manure, as sometimes carried out, by merely drilling in the seed without preliminary ploughing. The green manure rows should be ploughed 9 inches deep *before the seed is sown:* the growth will be the more luxuriant on the deeply worked soil and shallow root suppression will have been accomplished for that year.

Early winter ploughing also makes for better retention of the winter rains, which sink in instead of running to waste. It is remarkable that the value of deep and early winter ploughing receives more recognition in our irrigated vineyards than in those dependent on natural rainfall, and yet it is in the latter that its benefits are most pronounced.

In the best conducted Mildura vineyards, double and multi-furrowed ploughs are not now used for the first winter ploughing for the reason that they do not work to a sufficient depth. This operation is executed with the single-furrow plough, which penetrates more deeply. The extra cost has been found well worth while. Ploughing in winter to a depth of 10 inches, and even more, is not uncommon.

Though the application of the foregoing principles may be accomplished in various ways, local conditions determining the details, the following general instructions will suit trellised vineyards, irrigated or otherwise.

Plough deeply with the single furrow, as early in the winter as practicable, gathering the soil to the centre of the interval between the vine rows, and away from the vines. Lest the middle of the interval be left uncultivated, a deep furrow should first be opened here, the plough returning almost in the same furrow so as to turn the earth covered by the first sod. The whole of the land is thus worked with the exception of a narrow uncultivated strip between the vines in the row. This strip must be thrown out into the interval either with the horse drawn "grape and berry hoe" or with the hand hoe. To skim its surface with the long handled shovel is bad practice.

In early spring, the earth thus gathered to the centre is gradually worked back to the vine either with a multi-furrow plough or disc cultivator, filling the depression whence the strip was hoed out and leaving the whole surface level and loose. Subsequent cultivation is executed to a depth of 5 or 6 inches with spring tooth or such other type of cultivator as may best suit the soil of each particular vineyard. It should be frequently repeated, especially after rain or irrigation, in order to break the crust and re-establish the mulch. It must be shallower than the winter ploughing to avoid root injury.

The burial of the vine prunings in the interval between the vine rows is quite a good practice that is recently increasing in popularity. It necessitates some modification of the programme just outlined, as a deep furrow must be opened in the middle of the interval to receive the prunings.

Manuring and tillage are closely connected—green manuring has already been touched on. Artificial manures can best be applied at the

deep winter ploughing. Vine manure should be applied early and deep. In our dry climate, unless it is close to the roots, much of it fails to be absorbed within a reasonable time. Localization is also advantageous. The manure can best be sown during the winter ploughing, at the bottom of two of the furrows in each interval—one on each side of, and about 18 inches distant from, the vine row. This can be done by hand, or better, with one of those convenient attachments for fixing on to the single-furrow plough.

In conclusion, it may be pointed out that in Victorian vineyard practice, the evidence in favour of thorough tillage is overwhelming. Whether the land be irrigated or not, it is the well-worked vineyard that yields the heavy crops.

A Common Horse Ailment

(*Continued from page* 246).

To allay the inflammation and to promote healing, a mouth wash is used. One recommended consists of equal parts of powdered alum and boracic acid. One heaped teaspoon of the mixture is dissolved in 1 pint of cold water, and may be syringed into the mouth or even poured in from a bottle at frequent intervals. Where available, water from a hose pipe is an excellent and easy means of washing out the mouth.

Complications, such as those mentioned under the heading "Symptoms," must have expert treatment, and a veterinarian should be consulted.

Good nursing during treatment is essential. Feed should consist of green fodder and bran mashes, and chaff should be damped.

As the bit often aggravates the irritation, care should be taken when the winkers are put on. A young horse would be better if not worked while his mouth is bad, as there is every possibility of making him hard to bit for years to come.

Control.

For horses, only the best hay or chaff should be fed; it should be clean and free from barley and spear grasses.

It should be a routine duty, particularly during the dry months, to make an examination of the mouths of all horses under one's care. At such examinations any awns or seeds around the teeth should be removed.

Washing out the mouth with the hose is an excellent daily procedure. A few grass seeds sticking into the tongue or around a molar tooth act as a nucleus for the gathering together of many; if removed regularly trouble may be averted.

The Hand-feeding of Sheep

(*Continued from page* 234.)

other concentrated foods supply the greater bulk of the nutriment. Foods which are unpalatable, such as straws, hay, &c., may often be fed when mixed with a little molasses. Bales of straw have been soaked in a tank containing a solution of molasses and water, and fed with good results. Chaff, &c., can be damped in a solution of molasses broken down with from 5 to 6 parts of hot water.

5. Feed in Small Flocks.

It is always found, when feeding, that the strong sheep get in first, and the weaker are pushed to the rear. It is, therefore, advisable to have plenty of troughing accommodation. If the fodders are broadcast, it is essential to feed in small mobs; then the weaker sheep can be separated and fed together.

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

The Flower Garden.

THIS is the time of the year when extensive plantings may be carried out. New shrubs and ornamental evergreens may be put in, trees and shrubs transplanted, and cuttings of all kinds set out for rooting.

In preparing the beds or ground for new plantings, or transplanting, the soil should be dug over to the full depth of the spade, or even deeper. Before digging, a generous layer of old animal-manure may be placed on the surface, and then dug under, so that it shall be where the roots can reach it.

Give the plants a thorough watering a few hours before transplanting, so that a good quantity of soil may be transferred with the roots. Also, water all plants after planting to settle the soil around the roots.

All bulbs and allied plants, such as friesia, ranunculus, anemone, hyacinth, daffodil, narcissus, amaryllis, montbretia, watsonia, and lachenalia, should now be planted out. If manure is used, dig it well in, a couple of inches below the bulbs.

The Vegetable Garden.

This is the month for operations to be put in hand for the regeneration of the vegetable garden soil. The beds should be well limed, this being the most suitable time. A good dressing of lime or gypsum, even up to 8 oz. per square yard, should be well dug into the soil.

Beds of cabbage, cauliflower, and Brussell's sprouts should now be "hilled," working the soil up to the plants, covering the base of the stems, to induce stem rooting. The plants should be given regular doses of sulphate of ammonia to induce quick and regular growth.

Daffodil.

Set out plants, and sow seeds of all herbs, such as thyme, sage, parsley, mint, and marjoram.

The Orchard.

Consideration is now being given to new plantings of fruit trees, which will be done in the winter. For the orchardist there are three points for consideration. Firstly, that the varieties to be planted shall be suitable to the district, as while some varieties of apples, the Jonathan, for example, may be planted in almost all climates, yet the Dunn's variety should be planted only where it will not crack at the stem end.

Secondly, there is the necessity to plant only standard and well-proved export varieties, as all export varieties are suitable for the local markets, while all local types are not suitable for export. It would be well to eliminate all varieties that cannot be relied upon to give regular and satisfactory returns. Thirdly, comes consideration of canning varieties of fruits. While it may be possible to "can" many varieties, it must be remembered that the canning factory managements have to sell their products, and as they know the varieties that "can" well, and that bring the best prices, they are not likely to buy unsuitable fruit. Therefore, when planting for that purpose their advice should always be sought. Intelligent planting will save much worry in future years.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

Irrigated Pasture Investigations

Experimental Technique

By E. T. Beruldsen, B.Sc. (Agric.), and A. Morgan, B.Agr.Sc.

This Report on the technique of the irrigated pasture investigations at the State Research Farm, Werribee, has been prepared at the request of the Pasture Conference convened by the Council of Scientific and Industrial Research, and held in Adelaide.

THE pasture type on which work is being conducted at Werribee consists of an association in which rye-grass, cocksfoot, white clover, and subterranean clover are the principal components, the relative importance of any one of these species being governed by the particular treatment employed.

Manurial and Rate and Frequency of Watering.

The tests laid down in September, 1925, were intended to be demonstrational; consequently, the development of satisfactory technique in the various investigations has become possible only in the last three years.

A.—YIELD TRIALS.

In 1929 the lawn-mowing method of measuring production was adopted, using a 24-inch "Atco" motor lawn mower[1, 2].

1. Experimental Design.

(i) *Statistical Considerations.* — Various yield trials emphasized the fact that in order to get full value from the results of our experiments it would be necessary in later tests to conform with modern methods of experimental design[3], and to satisfy certain other statistical requirements. In regard to the latter, a number of uniformity tests was carried out, resulting in the following information:—

(*a*) *Size of Plot.*—Plots in excess of 300 square feet in area are unnecessarily large. (See footnote.)

(*b*) *Shape of Plot.*—Long narrow plots give consistently lower errors than plots of the same area which are square in shape.

(*c*) *Direction of Plot.*—Plots having their longer dimension across the bay give consistently lower errors than those of the same dimensions running down the bay. This is due to the effect of uneven watering (due to side fall) being minimized in the former case. Under irrigation conditions, therefore, plots are limited in length by the distance between checkbanks, the maximum recommended being 40 feet. Allowing 3 feet for the spread of the checkbank on each side, and 2 feet of headland alongside each checkbank, the length of the plot is limited to 30 feet.

(*d*) *Number of Replications.*—Although the theoretical "optimum" number for any size of plot is five, the number employed in any particular experiment has been governed by the nature of the differences which it is required to show significant, and by various practical considerations.

(ii) *Practical Considerations.*

(*a*) *The total area occupied* by a particular experiment should not be so large as to preclude the possibility of cutting the area within a short time. An unduly long

For brevity, actual experimental data in support of these and other statements is omitted from these notes, but may be obtained on request to this Department. Publication of the greater part of it may be expected in due course.

period (of more than three days) spent in cutting may seriously affect the validity of some comparisons—for example, in one instance where wet weather interrupted cutting for five days 50 per cent. increased growth resulted as compared with those plots cut before the interruption. Further, heavy dews often keep the herbage wet until midday.

In view of the above, the size of plot and the lay-out are such that at least one block of treatments can be cut in a short time.

(*b*) We have kept the view-point that too extensive an area might be required for the whole experiment if the theoretical "optimum" size of plot and the necessary number of replications are employed.

(*c*) It has been thought desirable to include in exploratory experiments a relatively large number of treatments in a single experiment rather than to strain at accuracy by the adoption of "optimum" size of plot and number of replications. For example, the new series of manurial tests are laid out in two Latin squares, each of nine replications of nine treatments, the plots being 200 square feet in area (22 feet x 9 ft. 1 in.); in the modified rate and frequency of watering tests, where three manurial treatments are now superimposed on each watering system, a randomized block of six replications of each manurial treatment has been laid down in each bay with a different watering treatment), each plot being 161 square feet (22 feet x 7 ft. 4 in.). (Av. S.E. of a single plot=7 per cent.).

(*d*) It is very convenient if the size of plot adopted is such as to enable the produce of that plot to be weighed in one operation, using a scales which is sufficiently accurate. (See "Weighing.")

2. Mowing Technique.

(*a*) Before the plots are cut a headland 2 feet wide is excised on each side of each bay, close to the checkbanks. These headlands are marked off by permanent pegs at each end of the bays, and temporary sighting pegs are used when cutting them; they are cut over twice.

(*b*) The top boundary of each plot is marked out by sighting on permanent pegs on the checkbanks; alternatively, the permanent pegs are put in along the side fences, and temporary pegs lined up with them prior to cutting. While the mowing of the plot is in progress temporary sighting pegs for cutting the lower edge are placed in position, using a measuring stick appropriately marked. With practice this operation occupies only a few seconds.

(*c*) The plots are cut over *at least twice,* as the stage of growth at which they are cut renders it impossible to collect all the herbage at the first mowing. In some instances (for example, an especially heavy growth on a heavily manured plot such as 4 cwt. super. per acre) it is found necessary to brush up the herbage and mow some patches a third or fourth time to thoroughly clean up the plot.

(*d*) Strips of at least 6 inches width remain uncut on each side of each plot; these are cut at the completion of the mowing of the plots,

Cutting the "Rate and Frequency of Watering" plots with the motor mower.

unless bad weather intervenes, when they are cut before continuing the mowing of the remaining plots. Where it is possible to leave strips of 2 feet width between plots they can be cut before commencing the plots. Half of each strip is manured at the same rate as the adjoining plot.

(*e*) The green clippings are emptied from the catcher of the mower on to a tared bag sheet, which is rolled up and suspended on the hook of a spring balance, weighing 40 lb. by 1 oz., and suspended from a wooden spar projecting from the lorry or dray in which the clippings are deposited after sampling for chemical analysis.

(*f*) Three men are required—one mowing, one marking-out and emptying the catcher, and one weighing and sampling.

(*g*) The time occupied in completing all operations on a plot of 200 square feet averages two minutes.

(*h*) The mower is set to remove all herbage at a height of ½ inch from the ground-level. It is a debatable point as to whether this setting results in a too severe defoliation of the grasses. However, as shown by the growth of meadow hay on plots which were rested after two years of the mowing treatment, no permanent injury to the grasses seems to result from it.

(*i*) The *stage of growth* at which the plots are cut is arbitrarily taken as 3 inches to 4 inches high; this entails cutting at intervals of approximately three weeks during the greater part of the year. During periods of slow growth it is inadvisable to allow intervals of more than six weeks between cuts if it is desired to obtain information in regard to the distribution of the yield. A great deal of difficulty is encountered if it is attempted to take off very heavy growth of more than the above average height.

(*j*) The average number of cuts per annum under this system is twelve.

B.—GRAZING TRIALS.

1. Experimental Design.

(i) *Statistical Considerations.*—Until the institution of the Rotational Grazing Trials in November, 1929, our only grazing tests consisted of a measurement of the number of sheep days that could be credited to any particular experimental field during an entire season, or during the period from the aftermath of a meadow-hay cut to the time of shutting up for the succeeding meadow-hay cut (usually, November to August).

The lay-out employed in the Rotational Grazing Trials has been fully described in a previous report[4]. Briefly, two 5-acre areas are used, one being divided into two 2½-acre plots and the other into ten ½-acre plots. The choice of site was governed by area available; the pasture was well established, the herbage fairly uniform, and the contours regular.

No preliminary work was undertaken in regard to experimental design, and consequently we have no information available in regard to (*a*) "optimum" size of plot, (*b*) shape of plot most suitable, or (*c*) number of replications desirable; but, concerning (*d*) the number of sheep necessary for the obtaining of a reliable mean live weight, it was found from a study of the results of a number of sheep-feeding experiments in Great Britain that this number was approximately 30. Subsequent analysis of our results has corroborated this.

(ii) *Practical Considerations*—

(*a*) In our rotational grazing trial, where a definite grazing system is adopted, and each plot must be grazed off thoroughly in a set period, the size of plot which has been employed provides adequate feed for the 30 sheep (specified above) at that period of the year when growth is slowest.

(*b*) The time occupied in one complete rotation of the sheep around the plots must be sufficiently long to give each plot a chance for recovery from the hard grazing; this applies particularly to the winter period of slow growth, when a recovery period of at least three weeks is desirable. Given a set period of grazing on each plot, this largely determines the number of plots to be used.

The above considerations were instrumental in our adoption of a small-plot system of ten ½-acre plots each of which is grazed for two days. (See "Regulation of Stocking.")

2. Regulation of Stocking.

Two tendencies are to be provided for in this connexion—

(*a*) A grazing system which functions satisfactorily during the period of slow growth suffers from some serious disabilities during a flush period, necessitating a change in the system at the latter period. Thus the high concentration of stock necessary (90 and over)

to feed off the plots in the specified time causes an objectionable amount of fouling, rendering a large proportion of the available feed distasteful to the sheep. Under these conditions our experience has been that one of the following courses may be adopted:—

(i) The recovery period may be shortened by moving the sheep round the plots more rapidly (e.g., grazing each plot for one day); in this case the number of sheep need not be increased to the point at which fouling becomes serious. A shorter resting period is necessary at this time, and any decrease in herbage production from increased frequency of grazing is not as serious as the wastage due to fouling.

(ii) The introduction of a suitable number of extra sheep into the rotation either in advance of the original sheep or as "followers." A period of four days between the two grazings of each plot eliminates the fouling effect to a large extent, and permits thorough feeding off.

Of the two methods, the latter is preferred on the grounds of efficiency and convenience.

(*b*) Where the aim of the experiment is to graze off the herbage as it is produced, it is found that slight changes in the number of sheep employed are necessary from time to time, the nature of the yield distribution under practical conditions not being uniform[1]. The most important factors to be considered when such a change in numbers is contemplated are—

(i) *The amount of feed available,* which may be estimated by eye or measured by the yield-sampling method.

(ii) *The trend of the live-weight variation* of a number of sheep which are continuously in the test. When withdrawing sheep from the test we have avoided the removal of the sheep which have been on the plots during the period of slow growth. Adverse weather conditions often cause losses in live weight, but unless the sheep show a continued live weight loss on the next weighing no reduction of numbers is made.

Of the two factors, the latter is considered of greater importance.

3. Weighing the Sheep.

(*a*) *Method.*—The sheep are run into small yards leading into a race at the end of which is an "Avery" platform scales carrying a wooden crate with sliding doors.

One man announces the eartag number and lets the sheep into the crate, while another weighs the sheep, records its weight, and releases the sheep. The tare of the crate is taken frequently during weighing, since moisture and the accumulation of dirt cause slight fluctuations in the weight of the crate, and is adjusted to a constant (100 lb.). The sheep are weighed to the nearest pound. By this method 100 sheep can be weighed in 1½ hours.

(*b*) *Time of Day.*—Weighing commences at 9 a.m. on each day of weighing. No fasting period before weighing is possible if the continuity of the grazing is to be maintained. A series of weighings at 9 a.m. and 3 p.m. on consecutive days for a considerable period demonstrated that the variability of the weights was the same in the afternoon as in the morning, although the afternoon weights were consistently higher.

(*c*) *Number of Weighings.*—The sheep are weighed half-way through each rotation period and again at the completion of the rotation. No repetition of the weighing on consecutive days is attempted. Although the "true" live-weight mean at any period is not obtained by one weighing (owing to considerable variation in the amount of undigested food held by the sheep) each lot of sheep remains on the plots for a year or longer, and it is considered that no wrong conclusions will be drawn.

4. Selection of Sheep and Marking.

(*a*) *Sex.*—Ewes are preferred, since the wethers used became subject to the disease "pizzle-rot" under conditions of intensive grazing. If the study of the reaction of the pasture to such intensive grazing is the primary object, the ewes should not be mated; if the possibilities of fat-lamb raising are to be investigated, the ewes are mated.

(*b*) Two lots are selected by weighing sheep from a large flock, and taking alternate sheep for each lot, rejecting those which vary considerably from the mean live-weight of the flock. By selecting more than actually needed at the time, a few may be maintained elsewhere until required as replacements necessitated by deaths, &c., or as "followers" in the flush period.

(*c*) Ear-tagging each lot on one ear enables a rapid draft to be made in the event of sheep breaking through fences, &c.

5. Yield Sampling.

(i) A full description of the method (in which a hand-shearing machine is used) has been published.[1] There is now proof that the size of sample arbitrarily used (8 square links —3 ft. 6½ in. x 1 ft.) is *not less than the* "optimum." Modifications of the technique were subsequently introduced, as follow:—

Cutting pasture samples—Rotational Grazing Tests.

(*a*) *Number of Samplings.* — It was orginally intended to sample two or three of the ½-acre plots at intervals of two months. The appetite of the sheep was found to vary very considerably from day to day, and from the stand-point of seasonal variation in appetite it was considered preferable to sample one plot in each rotation rather than to replicate the sampling at any one period.

(*b*) *Measurement of Growth during Grazing.*—The protection, and re-cutting after grazing, of samples cut before grazing, was unsatisfactory. This was particularly serious on the 2½-acre plots (ten days' grazing), and the sampling of these plots was discontinued.

(ii) *The application of the method to the study of the growth-rate of grazed herbage.*—The difference between the mean sample weight after a grazing and the mean sample weight before the succeeding grazing is a measure of the growth-rate of the pasture during the interval between grazings. This principle is applied to the study of the distribution of yield from grazed pasture.

In the Rotational Grazing Trials the method was applied during a period when the ten-day rotation was in progress on the small-plot system, and it was obvious that the sampling of a single plot at each rotation progressively enhanced the chances of sampling an area sampled in a previous grazing. Two adjacent plots comparable in productivity and botanical composition were therefore sampled alternately at each rotation. The yield-sampling method was also applied to the Rate and Frequency of Watering Tests, which were intensively grazed at intervals during the season 1932-33.

(iii) *Collecting Samples.*—In calm weather the cut herbage is left on the sampled area to dry out until sampling is completed; otherwise the sample is placed immediately in a numbered hessian bag (10 inches by 15 inches). For a period of one year each sample was kept separate for statistical purposes, after which the samples from a plot were bulked. In certain types of investigation a knowledge of the errors might be desirable at all times, and individual samples kept separate.

(iv) *Drying Samples.*—The samples are spread out on hessian trays in a drying oven of 300 cubic feet capacity, heated by two tubular 600-watt heating elements placed along the centre of the floor. A maximum temperature of 120° F. is obtained. A long flue leads from the centre of the roof, and the draught is regulated by a ventilator at the bottom of the door. After at least 36 hours drying, the samples are bagged and set aside for cleaning. Bulked samples cut under wet conditions need to be turned occasionally to prevent yellowing. The object of the drying is preservation until such time as cleaning and weighing can be done.

(v) *Cleaning the Samples.*—A large-mesh sieve is used to separate out the longer material, which is then easily cleaned by hand. The shorter material is dropped in front of a

3-speed electric fan, the draught from which is directed into a horizontal cylinder 11 inches in diameter and 17 inches long. The manure and small soil-pellets fall to the table while the dried herbage is blown through the cylinder and collected. The former portion may be put through several times, and is finally hand-cleaned. Dust is accounted for by putting all results on a silica-free basis. (See "Chemical Analysis.")

(vi) *Weighing the Samples.*—Separate oven-dried samples are weighed to the nearest 0.1 gm. on a chemical balance. Bulked samples are weighed on a steelyard to the nearest half-ounce (=to the nearest half-gramme per sample).

C.—BOTANICAL SURVEYS.

1. Method.

The "percentage estimation" method, as described in previous reports[1, 2, 4], is used. It is an application of the "percentage productivity" method as described by Davies[5].

2. Statistical Considerations.

(*a*) *Size of Sample.*—For various reasons[4], the 4 square link mesh (sample) is considered the most generally suitable.

(*b*) *Number of samples per plot; number of plots (replications).*—Where the botanical composition of a single small plot or plot-section of up to 1-40th acre is to be accurately determined, at least ten samples per plot are necessary[5, 6]. Where the mean of a number of similarly treated plots is required to be of a certain accuracy, modern lay-out enables this accuracy to be obtained with fewer samples per plot. For example, on Randomized Blocks of five replications of three treatments we find it sufficient to take four samples per plot of 161 square feet. The number of samples per plot and the number of replications may therefore be adjusted within fairly wide limits to suit practical convenience without loss of accuracy.

3. Practical Considerations.

(*a*) *The Time Factor.*—It is necessary to complete the botanical survey in the shortest possible time immediately before mowing or before grazing, particularly in periods of rapid growth. A maximum of two days is allowable, and this restricts the amount of detailed work which can be done by a small staff.

(*b*) *Grouping of allied species* may be allowable in certain types of experiment, greatly reducing the time necessary to survey any one plot and allowing greater replication if desirable. For example, in certain tests we group white clover and strawberry clover, lucerne, red clover and alsike clover, annual clovers and burr medick. In other cases division into total grasses, total clovers, and weeds is sufficient.

Steel quadrat used in making botanical surveys.

3. *Number of surveys per annum.*—A consideration of the following paragraph shows the necessity of a botanical survey before each cut or grazing; in the case of mowing trials about twelve surveys per year are necessary, while on the Rotational Grazing Trials about eighteen are required if the 20-day rotation is adhered to.

4. *Application of the method to the study of growth-rate of species.*—While the percentage figures obtained enable the *quality* of the herbage to be evaluated, it is often necessary[1, 2], to know the weights of each species present; this is found by applying the percentages to the weight of herbage present as determined by mowing or yield sampling. The graphical

representation of this data is essential to the comparison of a plot from cut to cut and from year to year, while the percentages are suitable only for comparison of a number of plots at any one time. Detailed discussion of these points is embodied in a paper prepared at the request of the Empire Agrostologist (unpublished as yet).

D.—CHEMICAL ANALYSIS.

1. Sampling for Chemical Analysis.

(*a*) *Mowing Trials.—Statistical Considerations.*—The determination of the moisture content of herbage is the most important consideration at Werribee, and it has been determined that for this purpose a sample of approximately 4 ounces of green herbage is sufficient. This is also the minimum size of sample acceptable to the chemist. The standard error per cent. of a single sample is from ½ to 1 per cent. No work has been done in regard to the optimum size of sample for complete fodder analysis. The practice has been to forward approximately 2 lb. of green herbage, which is the minimum size of sample acceptable to the chemist.

(*b*) *Grazing Trials.*—Since the number of yield samples taken gives an accurate estimate of yield and botanical composition, it is assumed that the bulked samples represent a satisfactory sample of the herbage for complete fodder analysis. It is inconvenient to forward such large samples, so the bulked samples are mixed as well as possible and reduced by quartering to the quantity held by a tin 6 inches diameter by 8 inches high. "Before grazing" and "after grazing" samples are analysed for moisture, silica, protein, crude fibre, silica-free ash, and carbohydrates + fats.

E.—WATERING TECHNIQUE.

A description of the soil conditions prevailing, the lay-out for irrigation, and the watering method employed has been published[1, 2]. The "border" system of irrigation is used, with 10 chains as the maximum length and 40 feet as the maximum width of bays, where moderate falls exist.

1. Factors in Accurate Measurement of Water Applied.

(*a*) *The Measuring Wheel.*—A small modified Dethridge wheel is used. The cyclometer attached to the standard wheel is used, but prior to installation the wheel was calibrated by measurement of the water passing the wheel at different rates of turning. The wheel records varying rates of flow with fair accuracy between certain limits; a rating curve was made, and as a result the flow of water generally used ranges about ½ cu. sec., the wheel revolving three times a minute.

(*b*) *Time Check.*—As a check on the constancy of the head, when watering each bay the time taken to register a certain amount is noted.

(*c*) *Concrete Channels.*—The use of concrete channels (22 inches across by 14 inches deep) from the measuring wheel to the head of the bays ensures that the amount of water measured at the wheel actually goes on the plot.

(*d*) *Judgment of point at which to cut water off each bay.*—As yet there is no practical method of measuring any drainage that may occur from a bay, and care is taken in judging the point at which it is considered that the back water will be sufficient to go through to the end of the bay. Only practice and knowledge of local conditions determine accuracy in this.

(*e*) *Procedure.*—The concrete channel is reasonably full before the outlet to the first bay is opened. When opened the irrigator notes the time, walks to the wheel and notes the register. The time elapsed between opening the outlet and reading the register is noted. When it is considered that sufficient water has been applied to that particular bay, it is quickly closed and the outlet to the next bay is opened, the time being noted. The irrigator must then arrive at the wheel to read the register within the time taken at the first operation.

2. Amount of Water Absorbed at a Watering.

In our watering test, under conditions of relative impermeability, it is impossible to apply in one operation the full amount of water a plot is scheduled to receive. When this is the case "supplementary waterings"[1, 2] are given. In applying supplementary waterings the consideration of 1 (*d*) is particularly important. Towards the completion of the watering, if only a very small amount remains to be applied, and it is considered that by waiting till the next day this amount will not spread over the whole bay, then only a few hours elapse before its application.

(*Continued on page* 260.)

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Bethune, Alexander Cecil	Lilydale
Bevis, Ralph Henry	Cheltenham
Bird, Henry William	Wedderburn
Blackham, W. H., Pty. Ltd.	Prahran
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Borwick, Peter Sinclair	Colac
Bourke and Thewlis	Benalla
Box, Arthur D.	Frankston
Brazel, A. J.	Camperdown
Brody, Walter Gairn	Benalla
Brophy, Foley, and Co.	Ballarat
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Burns, J. J., and Co.	Geelong
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Cavanagh, George	Camberwell
Cave, F., and Co. Pty. Ltd.	Melbourne
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Chenoweth, John	Kew
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Donoghue, Kevin	Bairnsdale
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		Young, Robert James	Horsham
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Wilson and Frazer Pty. Ltd. ..	Carlton		

Irrigated Pasture Investigations

(*Continued from page 257.*)

3. EVENNESS OF DISTRIBUTION OF THE WATER.

Apart from the judgment of the irrigator in shutting off the water from the bay, evenness of distribution proceeds from careful preparation and grading in the first instance. Erection of temporary or permanent cross-checks, which can be done without much concern in an ordinary paddock, can cause extremely uneven conditions in an experimental field, resulting in loss of accuracy and inconvenience in mowing trials.

In ordinary paddocks, the head of water can be split up over a number of bays, but differential watering of the bays results. In an experimental field where it is desired to water the bays uniformly, it is inadvisable to water more than two bays simultaneously from the one channel.

F.—MANURING TECHNIQUE.

Manures are applied from the drill, the spreader, or by hand. The drill permits regular application in well-defined lines, and is used where strips similarly treated extend across the bays. Experience has shown the rate of delivery to vary considerably, and so usually a test is made before top-dressing. This gives a guide in the setting of the drill. Further, the manure is weighed into the drill and the residue is weighed. In cases where an insufficient quantity has been used a supplementary dressing is applied by hand.

The spreader is used where a uniform dressing is given to a big area. Broadcasting by hand is employed where small areas are dressed and where single plots are dressed at odd times. By necessity the small plots in our Latin squares are dressed by hand. To obviate any mistakes the required manures are put into paper bags, labelled, distributed to their respective plots and checked over before application. For guidance ropes are stretched between the boundary pegs.

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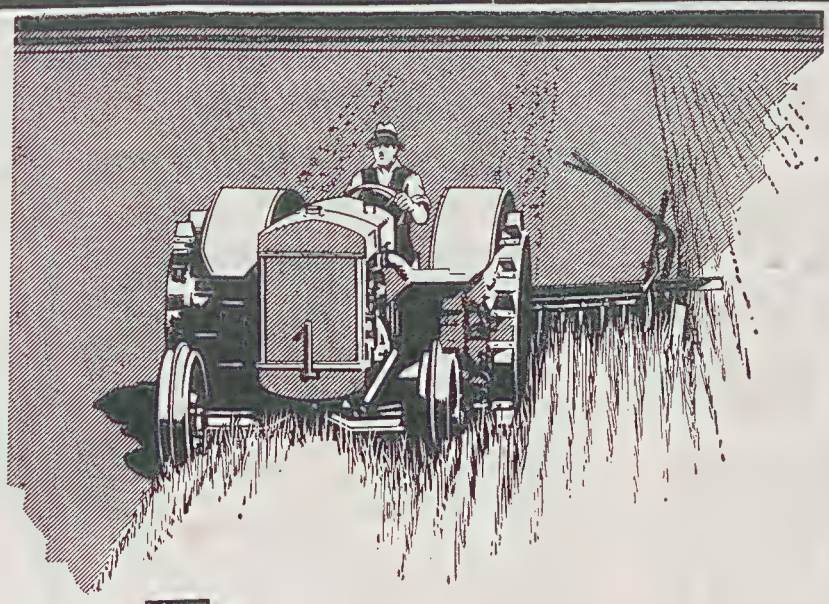

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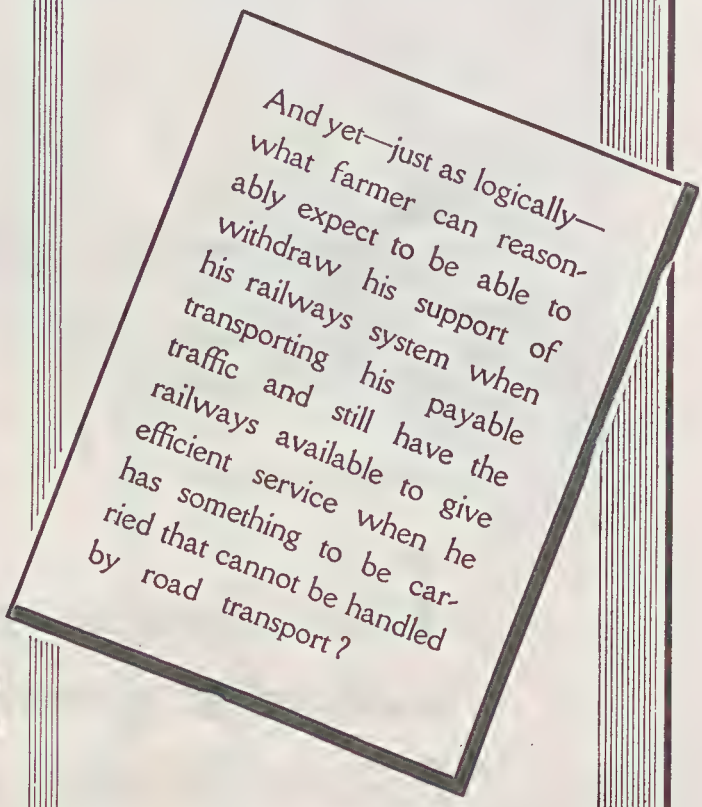
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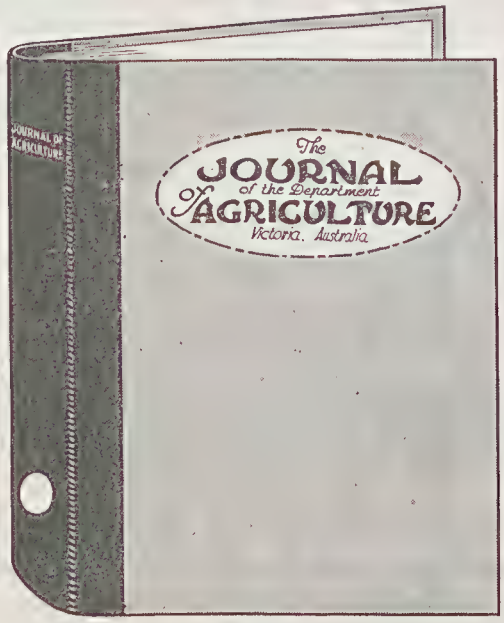

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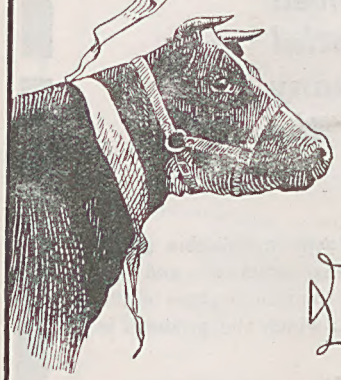

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Sire: VICTORIA JOYOUS MERCEDES (985) *Dam:* VICTORIA CORUSCATE (1419)
Price: 20 Guineas f.o.r. RUTHERGLEN
(This bull is at the State Farm, Rutherglen)

2. BULL CALF - - - Dropped 16th October, 1932.
Sire: VICTORIA JOYOUS MERCEDES (985) *Dam:* VICTORIA KEEL ROW (3260)
Price: 16 Guineas

3. BULL CALF - - - Dropped 12th November, 1932.
Sire: VICTORIA DOUBLE TOP (1354) *Dam:* VICTORIA ILKEDES (3763)
This is Victoria Ilkedes' first calf, and the record of her dam (Victoria Ilka Patch) on her first calf is 10,243 lbs. milk, 3·15% test, 322 lbs. butter-fat. *Being a heifer's bull calf,*
Price: 10 Guineas f.o.r. WERRIBEE

4. BULL CALF - - - - Dropped 29th March 1933.
Sire: VICTORIA JOYOUS MERCEDES (985) *Dam:* VICTORIA TINKLE BELL (3266)
Price: 23 Guineas

5. BULL CALF - - - Dropped 19th December, 1932.
Sire: VICTORIA JOYOUS MERCEDES (985) *Dam:* VICTORIA TOP PATCH (2634)
Price: 24 Guineas

Inspection cordially invited. For further particulars apply to—

THE DIRECTOR OF AGRICULTURE, MELBOURNE, C.2; OR THE MANAGER, STATE RESEARCH FARM, WERRIBEE

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No. 4—Ex Victoria Royal Divorce (2335 A) by Dominion Bright Belgian (1195 A) Dropped 17th November, 1932	15 ,,
No. 5—Ex Victoria Bushire (3012 A) by Victoria Brilliance (1258A) Dropped 6th December, 1932	12 ,,
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No. 7—Ex Victoria Pique (3028 A) by Victoria Iraq (Vol. 7) Dropped 29th November, 1932 *(A heifer's bull calf)* ..	10 ,,

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